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Section of Anæsthetics

President—H. P. FAIRLIE, M.D.

[*November* 3, 1933]

Anæsthesia in Gynæcology

PRESIDENT'S ADDRESS

By H. P. FAIRLIE, M.D.

ABSTRACT.—The operations of gynæcology are divided into two classes: (1) Minor: including perineal repairs, colporrhaphies, vaginal hysterectomies, dilatations and curettings, etc., and (2) Major: abdominal sections. For both groups routine premedication is a combination of morphia and nembutal, the former in $\frac{1}{6}$-grain, and the latter in 3-grain doses.

For Group 1 three methods of anæsthesia are described: (*a*) Ethylene and oxygen, producing in nearly all cases an adequate depth of anæsthesia without the addition of ether. A safe type of anæsthesia and one from which recovery takes place quickly. (*b*) Planocaine in 20% solution, made up with sodium bisulphate, as a spinal anæsthetic, described by Mr. Dickson Wright. The dose usually injected is 0·5 c.c. (*c*) Sodium evipan given intravenously, though rather uncertain in action seems to serve well for such minor operations as curettage and insertion of radium.

In Group 2 (major operations), the author's choice is between (*a*) ether administered with a little additional oxygen to counteract the asphyxial tendency which the Trendelenburg position occasions, and (*b*) spinal anæsthesia with percaine. For intra-abdominal pelvic surgery the latter is a very safe method for two reasons: (1) The dose required is comparatively small, and (2) the Trendelenburg position helps materially to prevent the fall of blood-pressure which a spinal anæsthetic tends to produce.

RÉSUMÉ.—Les opérations gynécologiques se divisent en deux groupes: (1) Opérations mineures: réparations du périnée, colporrhaphies, hystérectomies vaginales, dilatations, curettages, etc., et (2) Opérations majeures: incisions abdominales. Pour les deux groups on emploie comme prémédication une combinaison de morphine et de nembutal, la morphine en doses de 0·0108 grm. (1/6 grain) et le nembutal en doses de 0·194 grm. (3 grains).

L'auteur décrit trois méthodes d'anesthésie pour le premier groupe d'opérations: (*a*) Ethylène et oxygène: cette méthode donne dans presque tous les cas une anesthésie suffisante sans l'addition d'éther. Cette méthode est peu dangereuse et le rétablissement est rapide. (*b*) L'anesthésie rachidienne à la planocaïne à 20%, avec bisulphate de soude, préconisée par Dickson Wright. La dose habituelle est de 0·5 c.c. (*c*) Le sodium evipan intraveineux, quoique plutôt incertain dans ses effets, paraît utile pour les petites opérations telles que les curettages ou les insertions de radium.

Pour le deuxième groupe l'auteur choisit entre (*a*) l'éther avec un peu d'oxygène additionnel pour compenser à la position de Trendelenburg, et (*b*) l'anesthésie spinale à la percaine. Cette dernière méthode est très sûre pour deux raisons: (1) La dose nécessaire est relativement petite, et (2) La position de Trendelenburg aide à empêcher la diminution de pression sanguine qui tend à se produire comme résultat de l'anesthésie rachidienne.

ZUSAMMENFASSUNG.—Die gynäkologischen Operationen sind in 2 Gruppen geteilt: (1) kleinere, wie Dammreparationen, Kolporrhaphien, vaginale Hysterektomie, Dilatation, Kurettage, usw., und (2) grössere: Abdominalschnitt. Als Prämedikation werden in beiden Gruppen Morphin 0·0108 grm. (1/6 grain) und Nembutal 0·194 grm. (3 grains) gegeben.

Drei Methoden zur Anästhesierung bei der ersten Gruppe werden beschrieben: (*a*) Äthylen-Sauerstoff Anästhesie die in den meisten Fällen ohne Äther tief genug ist. Sie ist ungefährlich, und Erholung geschieht schnell. (*b*) Spinalanästhesie mit 20%iger Planocain

mit Sodium Bisulphat, wie sie von Dickson Wright beschrieben ist. Die dosis beträgt gewöhnlich 0·5 c.c. (*c*) Intravenöse Einspritzung von Sodium Evipan. Diese ist etwas unsicher in ihrer Wirkung, scheint aber gute Dienste in kleinen Operationen wie Kurettage und Radiumeinsetzung zu leisten.

In der zweiten Gruppe wählt der Verfasser entweder (*a*) Äther mit Zusatz von etwas Sauerstoff um der asphyxierende Tendenz der Trendelenburgstellung entgegenzuwirkin, oder (*b*) Spinalanästhesie mit Percain. Diese ist für intra-abdominelle Beckenoperationen sehr ungefährlich weil (1) die notwendige Dosis relativ klein ist, und (2) die Trendelenburgstellung wesentlich die durch Spinalanästhesie bedingte Blutdrucksenkung zu verhindern hilft.

On looking back over the Proceedings of the Section for a number of years, it occurred to me that the subject of anæsthesia in gynæcology had not received consideration for some time. It is a subject that appeals to me because I find that, in hospital practice at any rate, I have gradually adopted a routine for gynæcological operations which differs considerably from that which I employ in any other branch of surgery.

I think that, in the first place, I ought to make a confession. My views on chloroform have altered considerably since I addressed the Section at the meeting in Manchester in 1925. During the past eight years I have been using chloroform less and less, and, when the Secretary of the Anæsthetic Section of the British Medical Association Meeting in 1932 asked me to contribute a paper on chloroform, I felt compelled to decline. This change has been forced upon me not only because of the immediate danger of chloroform, but because I have become convinced that the delayed risk is a much more real one than is generally recognized. This failure of recognition is due largely, I think, to the fact that "delayed chloroform poisoning" is not always declared in the form of the classical textbook description. In many cases, if not in the majority, it is presented in a series of somewhat vague symptoms which are none the less due to liver poisoning and none the less dangerous. I refer to those cases which, usually about thirty-six or forty-eight hours after operation, begin to lose ground, gradually sinking, to the accompaniment of variable degrees of vomiting. This, however, is a digression.

The surgical field which I have chosen is a circumscribed one and perhaps for that reason lends itself to different methods of anæsthesia from those we employ in other fields.

I think I can best deal with the subject by dividing the cases into two groups: (1) Abdominal or major, and (2) vaginal and perineal, or minor, operations; this as regards the choice of the "key anæsthetic," if one may so term it. There is, however, a certain amount of ground common to both groups in the realm of preliminary treatment, and, to save repetition, I propose to deal with it first.

For many years my favourite pre-narcotics were morphine and hyoscine, a very potent combination. Hyoscine, however, I have largely replaced, owing to its too pronounced depressant effect on the respiratory centre. I still find it useful, along with morphia, in patients who are likely to prove resistant to other drugs—alcoholics and drug addicts.

With the advent of the numerous drugs which have been dubbed "basal narcotics,"—just why I do not know—many alternatives have been provided. I looked forward hopefully for the discovery of one which could be given by mouth until nembutal appeared. A drug which can be administered orally seems to me to have enormous advantages over one which requires administration either by the rectal or intravenous route. While I grant the relative uncertainty of nembutal given orally, it does produce, in nearly all cases, an effect which is sufficient for the purpose. It possesses the great asset of simplicity in administration, not requiring all the extra technique of those other methods. I have latterly then employed nembutal as a routine, giving, usually, 3 grains and combining it with a simultaneous hypodermic dose of $\frac{1}{6}$ grain of morphia, the time of administration half an hour

before the appointed operation hour. In very robust—and in very nervous—patients otherwise healthy, the dose of nembutal is increased to 4½ grains, and for women over 60 the dose is 1½ grain given with or without morphia—depending on the patient's physique and the type of operation.

The combination of these two drugs has a reinforcing effect very much more profound than if the same dose of one of them is employed alone. In nearly all cases the patient is brought to the theatre either asleep, or so drowsy as to be relieved of all the usual anxiety which the approach to an operation occasions. The excitement which one occasionally sees when nembutal is given alone rarely occurs after the combined dose is given. It is hardly necessary to enlarge on the necessity for quietness during this half-hour just preceding operation. We have probably all seen the whole picture spoilt by the misapplied, though well-intentioned, endeavour on the part of a friend to keep the patient cheery before operation.

Beyond this stage the two groups of operations receive different treatment, and I propose to deal with them separately, taking first the vaginal and perineal group, and secondly the abdominal group.

(1) Vaginal operations (including curetting, repair of perineum, Fothergill's, hysterectomies, etc.). In this group the anæsthesia demanded is not a very profound one and the method I employ is one of three :—

(*a*) Ethylene-and-oxygen is the anæsthetic I find most serviceable in this group. In the great majority of cases it is possible to get an adequate depth of anæsthesia without the addition of ether. Although I have spoken about ethylene previously, perhaps I may be allowed to go over some of the ground again, as it seems to be an anæsthetic about which considerable misconception exists.

Its administration is almost identical with that of nitrous oxide and oxygen, the differences being (1) that a rather higher percentage of oxygen is required, from 10 to 20%, and (2) that precautions against fire must be observed similar to those necessary for ether. With due observance of those two points, ethylene is a very safe anæsthetic. As a result of the higher oxygen content of the mixture the patient is only slightly or not at all cyanosed. If, as happens in occasional cases, sufficient anæsthesia is unobtainable without pronounced cyanosis, it is better in the interests of safety, instead of cutting down the oxygen percentage, to have recourse to ether. I have never seen a case of serious collapse under ethylene. Transient respiratory embarrassment does occur if too little oxygen is allowed, and until the deficiency is made good. Better, therefore, in the few cases which do not respond to ethylene without cyanosis occurring, to maintain an adequate oxygen content and bridge the difficulty with ether, which is only required in small quantities and for brief periods. In other respects the anæsthesia differs little from that of nitrous oxide and oxygen. The respiration perhaps tends to be quieter and shallower. There is a similar effect on blood-pressure, with the resulting tendency to increased hæmorrhage. As regards after-effects it again differs little from nitrous oxide. I have very rarely seen the headaches which are said to be frequent sequelæ. Sickness incidence is slightly higher than after nitrous-oxide-oxygen, but the type is transient. Many patients vomit immediately on the cessation of the administration, before completely conscious, and that is the end of it. It is uncommon to see a severe or lasting type of sickness. Chest complications are rare.

There remains to say a word about the obnoxious smell. Fortunately, in the concentration which a patient receives, this passes almost unnoticed. Why, I cannot explain. The objection is voiced by the others present in its vicinity. My experience is that the resentment expressed varies considerably : some appear to object very little, others very much.

With this combination of nembutal, morphine, and ethylene oxygen I find it possible to obtain satisfactory results in most of what might be termed the minor operations of gynæcology.

(*b*) For those cases in which it is undesirable to employ general anæsthesia, e.g. when some form of respiratory complication is present (although ethylene is not in itself irritating, the possibility of the enforced addition of ether is always in the background), a low spinal anæsthesia is very well adapted. I have found the method described by Mr. Dickson Wright in urological surgery to be very serviceable. I have never tried sacral anæsthesia, but, from what I have read about it, it seems to me that a low spinal presents an easier technique and is more certain in its effects. Mr. Dickson Wright uses ampoules of planocaine in 20% solution made up with sodium bisulphate to render it hyperbaric. The injection is therefore made in the sitting position and the patient's head and shoulders are raised throughout the operation. The dose varies with the type of operation. For the majority of minor gynæcological operations 0·5 or 0·6 c.c. suffices, but for a Fothergill or vaginal hysterectomy, in which traction on the fundus or broad ligaments is probable, a larger dose is demanded (0·7 or 0·8 c.c).

In my earlier cases, working with doses of 0·5 c.c. I found that, in those operations, acute discomfort, or even pain, was complained of during such traction. A slightly larger dose obviates those complaints. The resulting anæsthesia lasts for from an hour to an hour and a half, after which the return of function is rapid.

(*c*) Finally, in this group I think sodium evipan, although a very recent arrival, is worthy of a place, at any rate for what might be called the most minor operations. For dilatation and curettage, removal of polypi, and insertion of radium, it seems to act very well in most cases. My experience so far has, however, indicated that there is some uncertainty of action. One patient will develop an anæsthesia of a most satisfactory type, while another will evince very disconcerting reflex movements throughout the operation. Perhaps with wider experience of dosage this difficulty will be overcome.

(2) *Abdominal operations.*—When we come to consider the major operations of gynæcology, other methods of anæsthesia are necessary. The methods which I have described as suited to their particular field are not profound enough in action to satisfy the requirements of a laparotomy. It is, of course, possible to rely on ethylene-oxygen or nitrous-oxide-oxygen, with the addition of ether, more or less plentifully, to achieve adequate relaxation of the abdominal muscles. But in practice this amounts, to all intents, to an ether anæsthesia. If ether is to be my choice I prefer to use air as the vehicle to convey it to the lungs rather than gas and oxygen. The comparison as regards after-effects of a gas-oxygen-ether anæsthesia in such cases and an air-ether anæsthesia, the latter followed by the judicious use of carbon dioxide, does not induce me to use the more elaborate method. I do find, however, that with the degree of Trendelenburg position which is usually required for pelvic surgery, a little supplementary oxygen led under the ether mask, or through the endotracheal or pharyngeal tube, if those methods are employed, is almost essential.

The abdominal operations of gynæcology are specially adapted anatomically to the employment of spinal anæsthesia, and in hospital practice I have been relying on it increasingly.

Except in very infrequent cases (e.g. where a very large tumour is present or where exploration of the higher viscera is desired), only the lower abdomen requires to be controlled. None of the risks associated with large dosage are therefore entailed. Furthermore, the routine use of the Trendelenburg position counteracts the fall of blood-pressure which so often accompanies spinal anæsthesia. My experience has been that, working with the small doses which suffice, the effect on blood-pressure is rarely noticeable. For some years now, following the technique which Mr. Howard Jones has described, I have employed percaine, and as the operations are rarely of long duration, in ampoules of 1 : 2,000 dilution. The resultant anæsthesia and relaxation are most satisfactory and may be relied on to

continue for an hour and a half. It is unnecessary, in view of Mr. Howard Jones's admirable papers on the subject, to enter into details of technique. There are one or two points, however, which might be mentioned. I usually choose the third lumbar interspace for the injection and carry it out, where possible, with the patient in the lateral position. And, although realizing the importance of keeping the head down, occasionally I find great difficulty in reaching the theca with the patient thus placed. In those cases, rather than persist in the attempt, which is decidedly unpleasant from the patient's point of view, I adopt the sitting position, getting the patient down as quickly as possible when the injection is completed and having the table slightly tilted, head downwards. I usually follow Mr. Jones's advice in having the face-downward position for five or ten minutes immediately after injection, but I do so with a certain amount of doubt as to its real necessity. In the case of elderly—and, particularly, of stout—patients, it is a decided obstacle. The proximity of the two sets of nerve-roots, anterior and posterior, make me wonder if the anæsthetic could miss one set while reaching the other. For the average case the dose employed is 10 c.c. When a large tumour is present, or when for any other reason the incision is likely to extend more than an inch above the umbilicus, 1 or 2 c.c. more are added.

As to the comparison of the relative merits of this method with general anæsthesia, it has to be considered in two phases: (1) immediate and (2) remote.

(1) Immediate.—First of all from the patient's point of view, there is the preliminary puncture to consider. To a patient well under the influence of nembutal and morphia this is usually negligible and often forgotten in a short time, as is also the whole period in the operating theatre. In exceptionally nervous people or in those cases where the response to nembutal-morphia is defective, rather than have a nervous jumpy patient I prefer to induce a light nitrous-oxide-oxygen anæsthesia. There must be considered the rare case of failure of action of percaine. Then, of course, it is necessary to induce a full general anæsthesia. Regarding the question of risk, nearly all the factors in a pelvic operation tend to reduce it to a minimum. In the first place the dose need not be large, in the second the patient's position is the most favourable for keeping up the blood-pressure, and lastly there is no shock comparable to that occasioned in operations in the upper-abdomen. My experience has been that the fall in blood-pressure is slight, never such as to cause me any anxiety, a statement I could not make in connection with percaine for high laparotomies where I have seen some decidedly alarming falls in blood-pressure.

(2) Remote.—In the post-operative period I think that there is a decided gain. The incidence of nausea and vomiting and chest complication is definitely reduced, while the after symptoms peculiar to spinal anæsthesia are decidedly less common with percaine. Headache is an occasional sequela but never, in my experience, of the severity and duration which I used to see following stovaine. Similarly with nerve complications they have been conspicuous by their rarity and never of more than two or three days' duration. In three cases I have seen the auditory nerve affected, evidenced by deafness and tinnitus, none of them of more than four days' duration. I have not seen ocular paralysis after percaine.

Discussion.—Dr. H. W. FEATHERSTONE said that the uncertain behaviour of nembutal when given by the oral route had been referred to, and attributed this to one or more of three possible causes. In patients who were particularly apprehensive, the pyloric sphincter was closed, in many cases, for a considerable time after the ingestion of food or drugs into the stomach, and it was possible that such patients might retain the swallowed capsules of nembutal in the stomach for some hours without passing the drug on to the duodenum where it could be absorbed. Secondly, it was probable that the barbiturate, if left in contact with the acid gastric juice for any length of time, would be precipitated in an insoluble and relatively unabsorbable form. Furthermore there was the chemical constitution of the drug to be considered, for much of its activity depended upon the presence of an asymmetric

carbon atom, and it was possible that some specimens were more potent than others. Thus possibly the dextro-rotatory portion might be more active than the lævo-rotatory moiety, and some specimens might be more rich in the dextro-rotatory barbiturate than others.

He had found that ether anæsthesia, preceded by nembutal and morphine, could not be relied upon to produce relaxation in abdominal section.

For spinal anæsthesia, he found that planocaine did not last long enough in many cases, and that percaine was much superior in this respect. When working with Dr. Howard Jones' hypobaric percaine, experience seemed to confirm the need for placing the patient in the face-down position for five minutes or longer following the injection of the solution of percaine. The discomfort which this occasioned to many patients seemed to be the greatest drawback of the method.

Dr. RONALD JARMAN: With reference to evipan: I have anæsthetized, in all, over 500 cases with this drug, and my standard premedication is omnopon gr. $\frac{2}{3}$; scopolamine, gr. $\frac{1}{150}$.

The premedication is given one hour before the operation. The patient is brought into the theatre and everything is prepared for the operation; only when the surgeon is actually ready to make the incision is the evipan injected into the median basilic vein of either arm.

I have used this anæsthetic with considerable success in gynæcological operations, such as examination. dilatation and curettage, insertion of radium and repair of vaginal wall. The only important part of my technique is that of keeping a clear airway and not leaving the patient on any account whatsoever, from the time the evipan is given until consciousness is completely recovered. I found that with the premedication described above and either one or two doses of evipan, almost all the minor operations in gynæcology can be performed in comfort.

The sequelæ of evipan administration are few. I have been informed that three patients complained of headache and slight vomiting. Actually these symptoms have been only temporary; by the following day the patient has been perfectly normal.

The great advantage of percaine in gynæcological operations is that the anæsthesia lasts so long after the operation that the patient suffers no pain or unpleasant symptoms. This feature is a great boon to women after operation for repair of the perineum or vaginal wall. With all abdominal work in gynæcology percaine is ideal. If it is desired that the patient should not know that there will be a spinal anæsthetic, either evipan, or gas-and-oxygen may be given before the spinal injection and during the rest of the operation. No ill-effects ensue from giving evipan and percaine together.

Dr. Z. MENNELL said that he considered gynæcological work easy from the anæsthetist's point of view, as it was notoriously simpler to obtain safe relaxation of the abdominal muscles in the lower quadrant of the abdomen than in the upper.

His practice was to use gas-and-ether for the induction, and while the abdominal wall was being opened, and after that to continue with gas-and-oxygen, with the addition of a little ether when the wound was being closed.

There were certain cases in which the use of chloroform was justifiable, especially those of obese women with a certain amount of bronchitis, because the use of chloroform was very much safer in the Trendelenburg position and also because only a light anæsthesia was necessary to produce relaxation.

He had tried most of the methods that had been discussed, but he preferred to use the ordinary simple general anæsthetic methods for these cases, and it was remarkable what a small quantity of a general anæsthetic gave satisfactory results. He did not use any of the so-called "basal anæsthetics" unless they were especially asked for, or unless the patients were unusually nervous.

Dr. HOWARD JONES: Members have asked if it is necessary to turn patients into the ventral position after injecting dilute hypobaric solutions. It is probably forgotten that the first injections of percaine solutions were made with 1 : 1,000 in normal saline S.G. 1006 on the assumption that this approximately isobaric solution would meet all requirements for high thoracic block. The results were not constant owing to the variable specific gravity of the spinal fluid, and therefore the 0·5% saline solution S.G. 1·003 was adopted in order to have a definitely hypobaric fluid. All the first injections with this solution were made without turning the patient and results were obtained, but with an even greater tendency to deficient analgesia in the upper zones of the abdomen. This solution does not move of its own accord but the heavier spinal fluid is always the disturbing agent, and in the dorsal decubitus the

sacral fluid will run down in the posterior compartment, washing the posterior roots and spoiling the analgesia, and there will be a corresponding recession of the injection from the upper roots with a tendency to block anterior roots only. For this reason the ventral position was adopted and it is now better to view the method in a different light.

The method of direct injection is merely an infiltration of the cerebrospinal fluid as far as the fifth roots, which lie under the fourth dorsal spine and is only a manœuvre in regional anæsthesia. When the curve of the spine is examined in the ventral position it can be seen that this is the only possible position in which the body can be placed without having the injection disturbed and diluted by spinal fluid, and this is the reason for the consistent results obtained. If the volume injected is small it will spread as far as the highest point of the curve but will suffer dilution. For pelvic work the injection should always be made between L 4-5 and the patient placed in the ventral decubitus in Trendelenburg slope in order that the smallest amount of sacral fluid may come into play.

When using spinal block it is necessary to look back through the mechanics of the patient. For example in suffocative lung conditions the patient may be getting only just enough oxygen.

If the blood-pressure is dropped the pulmonary circulation suffers and the oxygen supply is then insufficient, apart from the paralytic effect on the respiratory muscles.

The high Trendelenburg position for gynæcology introduces serious mechanical disadvantages for the patient. In the upright position the weight of the lungs assists inspiration, but in the reverse position the diaphragm acting alone if the intercostal nerves are blocked, has to pull up the lungs as well as the heavy abdominal contents and if packs are used may be seriously impeded. As a contrast a plus pressure tracheal insufflation tends to support the lungs and assist inspiration.

Emphasis must be laid on the measurement of the spine as a method of estimating the correct volume to inject, for if 14 c.c. are used when 20 may be injected the full benefit of the method is not achieved. The lower the injection is made the larger in proportion must be the volume for high blocks.

The concentration must be tempered to the requirements of the patient and for gynæcology Dr. Fairlie's practice of using 10 c.c. of 1 : 2,000 solution seems to be very sound.

For perineal work 0·6 c.c. of the 1 : 200 solution of percaine S.G. 1·006 may be used between L 4-5, leaving the patient on the side for a minute and then turning on to the other side in order to avoid a unilateral effect.

The stovaine solutions on the market are all very heavily loaded, and although quite sound when used in small dosage in the sitting position for perineal work, are very dangerous in high dosage if the Trendelenburg position is adopted too early, because the phrenics may be reached. The mortality from these solutions has been very high.

Dr. F. F. WADDY said that he mistrusted the combination of nembutal and spinal anæsthetics. The use of gas-and-oxygen to supplement spinal anæsthesia was fraught with grave danger. During a pelvic operation the patient suffered from the following disabilities: (1) The lungs in the Trendelenburg position were upside down and, as Dr. Howard Jones had already pointed out, they could not fully expand; (2) the weight of the viscera was on the diaphragm, the movement of which was further impeded by the packing in of swabs; (3) the lower intercostal muscles were paralysed by the spinal anæsthetic; (4) in most cases the patient had had a preliminary dose of some hypnotic which was also a respiratory depressant.

The whole stage was therefore set—in the position, the operative procedure, and the drugs used—to bring about an anoxæmia which might—and had occasionally been known to—prove fatal.

Gas-and-oxygen was too deficient in oxygen to be effective as an anæsthetic—as compared to the air usually breathed—and this factor might well complete the disaster previously threatened by oxygen lack.

He (the speaker) strongly advocated the use of pure ether with excess oxygen as the supplementary anæsthetic.

Dr. CHARLES HADFIELD said that perhaps he was somewhat conservative, but he still continued to use the so-called "light" solution of stovaine for spinal injection in gynæcological abdominal operations. In spite of theoretical objections he placed the patients in the high

Trendelenburg position at once and had never had reason to regret doing so. His only objections to stovaine were that he found it unsatisfactory in cases in which the field of operation extended much above the umbilicus and that the analgesia obtained was likely to prove too short for unusually prolonged operations such as Wertheim's hysterectomy. In these two classes of case he very gladly resorted to percaine, but with these exceptions he still found stovaine more expeditious, less troublesome, and equally efficient.

In the absence of some special indication he did not feel justified in using spinal analgesia for most of the minor gynæcological operations usually performed in the lithotomy position. For such cases he considered nitrous oxide and oxygen, with a little added ether, more suitable.

Section for the Study of Disease in Children

President—F. C. PYBUS, M.S.

[*October* 27, 1933]

Sprue commencing at 11½ years of age.—REGINALD MILLER, M.D.

R. M., male, aged 13 years, fourth of family of five children. Born in November, 1920. In 1925 went to live in various parts of Ceylon; kept well, and returned to England in excellent health and eating well, in October, 1931. Attended day-school.

In April, 1932, then aged 11½ years, he began to have pain in the abdomen with vomiting and diarrhœa. He wasted considerably, and was very listless and irritable. His abdomen became very big. By October he was in bed, and at about this time he began to suffer from sore tongue. At one time he had a deep ulcer under the tongue. The diarrhœa continued; the stools were four or five per day, large, pale and frothy. He was at first given a low-fat diet for a month, but later was regarded as a case of abdominal tuberculosis and given fatty foods. He wasted down to 3 st. 9 lb.

On August 9, 1933, after being ten months in bed, he was admitted to St. Mary's Hospital. His weight was 4 st. 1½ lb., and his blood showed a colour-index of 1·3 (R.B.C. = 1,400,000; Hb. = 36%). He was given a modified fat diet, and ordered liver extract, marmite and hydrochloric acid. During August he lost weight, and his anæmia did not improve (see table). On September 1 he was given 300 c.c. of blood intravenously.

On September 3 his condition was as follows: He was very wasted and shrivelled, and intensely anæmic. His tongue was pale and very smooth; there was widespread atrophy of the papillæ, but no soreness, and no ulcers. The abdomen was much distended with gas; the stools, about two per day, were large and pale, unformed, but not liquid. They showed no evidence of colitis, and contained nothing abnormal except excess of fat. Skiagrams showed no changes in the bones. The boy showed the perversions of appetite and temperamental difficulties that are seen in cœliac disease.

On September 4 he was given a stricter diet containing a minimum of fat, all the other treatment remaining unaltered. Since then there has been rapid improvement; in six weeks he has gained 1 st. in weight and his hæmoglobin has risen 36%. Within ten days of the alteration of his diet he was asking for second helpings, and his various peculiarities of appetite and behaviour have disappeared. Lately he has had massage and ultra-violet light treatment. His tongue is now less typical of sprue than six weeks ago. The motions are formed and constipated.

Diagnosis.—In spite of the fact that the first symptoms occurred at the age of 11½ years, the diagnosis of sprue seems justified by the state of the tongue, the fatty diarrhœa and the severe hyperchromic megalocytic anæmia.

Date 1933	Weight st.	lb.	Blood-counts R.B.C.	Size	Hb. %	C.I.	Fæcal analyses Total fat per cent.	Per cent. fæcal fat Soap	F. acid	N. fat
Aug. 9	4	1½								
,, 14	4	1½	1·4	8 μ	36	1·3	23·4	40·6	34·2	25·2
,, 21	4	0								
,, 28	4	0	1·28	8·5 μ	40	1·6				
Sept. 4	3	10½								
,, 11	3	12¾	2·42	—	50	1 +				
,, 18	4	1½								
,, 25	4	2½	2·3	8·5 μ	60	1·3				
Oct. 2	4	5½					15·4	66·9	29·2	3·9
,, 9	4	6¾	2·4	—	64	1·3				
,, 16	4	10¼	2·9	8 μ	72	1·25				

Strict diet commenced September 4. Blood transfusion (300 c.cm.) September 1.

I do not think that the diagnosis is in doubt. The boy's mother tells me that from the characteristics of the tongue and stools, she has always thought that the boy was suffering from sprue. The case is unlike any other example of steatorrhœa in a child which I have seen. Even if I thought cœliac disease could arise in older subjects, the comparatively quick development of severe hyperchromic anæmia and the rapid improvement under treatment are unlike anything I have seen in cœliac disease. Abdominal tuberculosis is out of the question. If the diagnosis is accepted the case seems an exception to the rule that sprue does not occur in children, though I admit that symptoms did not develop until the age of 11½ years, which is by no means early childhood.

It is interesting that this boy showed all the temperamental characteristics of cœliac disease: the misery, the negativism and refusal of food, and the same capacity to vomit foods which he thought he did not like. On a strict diet these symptoms disappeared very quickly, far more so than in cœliac disease. In his first week he gained 2 lb. and in two weeks he was asking for second helpings.

Another point raised by this case is the relative importance of the administration of liver and the low-fat diet in the cure of sprue. The boy was in hospital throughout August on a full anti-anæmic treatment with a modified fat diet without improvement, and the substitution of a really strict diet seemed to make all the difference. This seems to suggest that liver therapy, though doubtless it keeps alive patients who would formerly have died, acts at a great disadvantage in the presence of a diet too rich in fat.

Lastly there is the question how the comparatively small extra reduction of fat in the diet here made so great a difference. I take this to be due to the fact that the stricter diet abolished intestinal hurry and thus allowed time for the proper soaping of the fæcal fat. The symptoms in steatorrhœa depend upon the form in which the excess of fat is passed. If it is in the form of neutral fat the child suffers from deprivation and remains thin and perhaps small, but is not stunted or ill or miserable. Congenital steatorrhœa is the type of this condition. If the excess of fat is passed in the form of fatty acids we get the picture of the untreated cœliac child, where the symptoms are due (in my opinion) more to toxæmia than to deprivation. If by strict diet the intestinal hurry is so slowed down as to allow the fats to be efficiently soaped, we get freedom from toxæmia with progress and renewed growth as in the properly treated case of cœliac disease.

Discussion.—Dr. MANSON-BAHR said he had no doubt whatever, that the diagnosis of sprue in this case was correct. The appearance of the tongue, combined with the history of the case, the megalocytic anæmia and the gratifying response to treatment, all proclaimed this as a genuine case of sprue. He had always regarded sprue as being exceptionally rare in small children, and about twenty years ago he had been engaged on an investigation in Ceylon in those very districts in which this patient had become infected. Most of the cases of so-called sprue in children that he had seen, eventually turned out to be

either cases of bacillary dysentery or of cœliac disease. The youngest case of genuine sprue he had seen in Ceylon was a boy aged 13 years; but he was not of pure European parentage, and the youngest he had seen since that time was a boy of 18 who contracted the disease in Java. Sir Patrick Manson, too, who had first described the disease in Hong-Kong, had always averred that he had seen only one case in a child, that of a boy aged 12 years. In well-marked cases of sprue in young people, there should be no great difficulty in differentiating it from cœliac disease, and Dr. Miller had already emphasized the chief points in the differential diagnosis. Sprue was essentially a disease of adult life, and appeared to be specially likely to attack those who had been long resident in the endemic area; it was this fact that led Manson originally to make his famous pun, that "the noun 'Sprue' was but the past participle of the verb to 'spree.'" The disease often appeared first in its typical form in people who had left the tropics for good; sometimes it made its appearance one year after residence in England, and sometimes fifteen years or longer, and it must be assumed that the virus of the disease, whatever it might be, was capable of lying latent and harmless in the human body for this very great length of time. Another curious point was the predilection of the disease for the European, and, as had been frequently pointed out, the darker the skin, the less liable was its possessor to develop the disease. Certainly sprue also occurred in dark-skinned natives, but he had yet to see a case in the full-blooded negro. The third peculiarity of this mysterious disease was its geographical distribution; it was a disease begotten and engendered in the tropics, yet it did not seem to occur (commonly at any rate) in Central Africa. These were points for consideration in regard to a disease which still remained one of the mysteries of tropical medicine.

Dr. HAMILTON FAIRLEY agreed with the diagnosis of tropical sprue. The residence of six years in Ceylon, the absence of any illness suggestive of cœliac disease in childhood, the typical tongue, the distended abdomen with gaseous fatty stools, and the megalocytic anæmia all supported this diagnosis. Furthermore, after leaving the tropics, a latent period (six months in this case) was not uncommon before sprue manifested itself, while the response to treatment was typical. On a high-protein, low-fat, low-carbohydrate diet and adequate doses of liver extract, patients with tropical sprue now recovered with almost mathematical precision.

Owing to the youthfulness of the patient (11½ years) this case was very important, as sprue was exceedingly rare in children; it would be valuable if information concerning the glucose-tolerance curve and total blood-calcium could be added to the important data already given.

Mongolism and Achondroplasia in Twin Brothers.—C. P. LAPAGE, M.D.

The mother is a young primipara, healthy except for high blood-pressure (146) and shows no sign of endocrine gland deficiency. She has no resemblance to a mongol. The family history was negative for achondroplasia.

Twin E., (fig. 1), an undoubted mongol, recognizable from birth, died aged 5½ months from bronchopneumonia, but had been gradually losing health. Twin P (fig. 2) had achondroplasia. He also died from bronchopneumonia, having had rapid breathing at times. An X-ray examination for atelectasis was negative.

Measurements:—

	At 2 months		At 7 months
Head circumference ...	14¾ in.	...	17¾ in.
Length of arm ...	2 „	...	2¾ „
Thigh	2¾ „	...	3 „
Leg	3 „	...	3 „
Trunk	7 „	...	9½ „

It will be noted that, whereas the spine has grown 2½ in., the limbs have grown much less in proportion. The head also shows a considerable increase.

There are many references to mongolian twins in literature, and a very full list can be found in Brousseau and Brainerd's book, but I have not been able to trace any references to the occurrence of the combination of mongolism and achondroplasia, though one or both of twins may be achondroplasic.

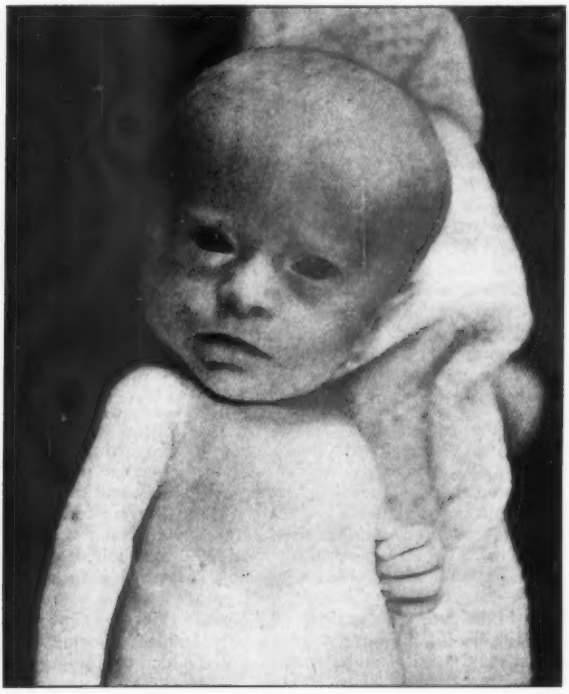


FIG. 1.
The Mongol Twin.

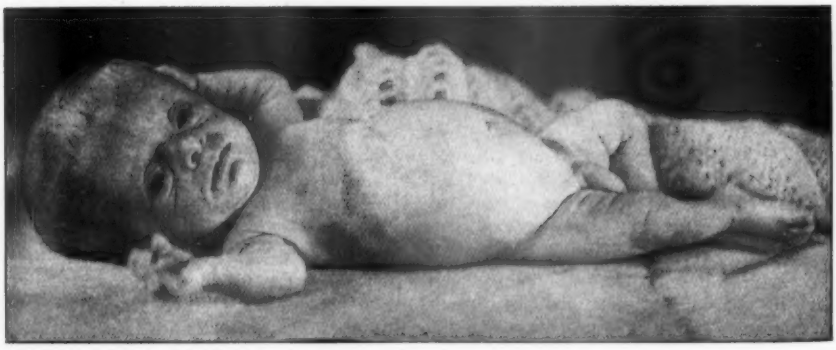


FIG. 2.—The Achondroplasic Twin.

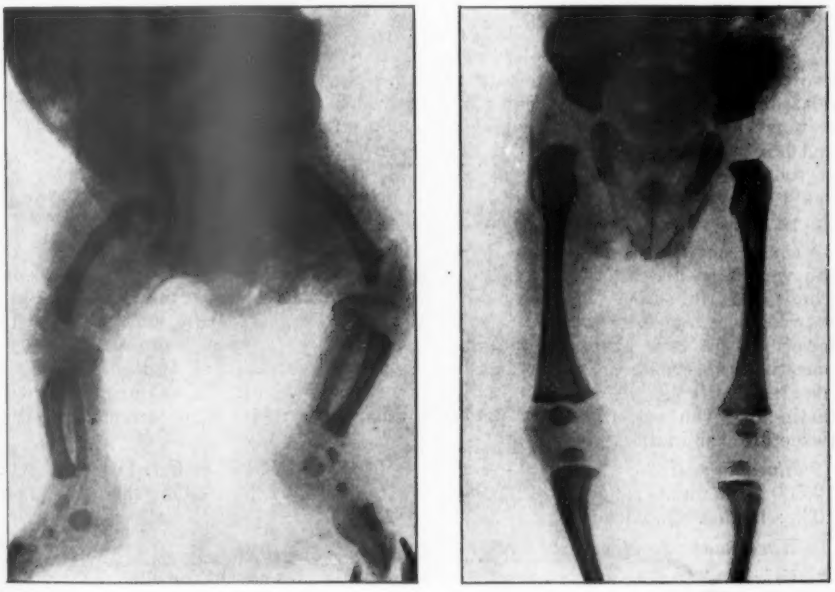
In Brousseau and Brainerd's book Jansen is quoted as calling attention to the fact that besides the results of direct pressure, mongolism shows dwarfism of other parts. He says :—

"The mongoloid idiot is undersized . . . the extremities of the mongoloid idiot show some or all of the characteristics of the achondroplast. Thus, an intimate relation appears to exist between mongolian idiocy and achondroplasia.

Warner reports a case of achondroplasia in a twin, and Pritchard an atypical case of achondroplasia in another twin.

I am much indebted to Dr. R. S. Paterscn, President of the Section of Radiology, for his interest and care in oreparing the skiagrams. His report is as follows :—

"It was possible to get radiograms of the achondroplasiac twin at the age of nine weeks and it is of interest that the typical changes in the long bones were recognizable at that time. At the age of three months further radiograms were taken with a control child of the same sex and age (fig. 3). These are reproduced alongside and the contrast is well marked. It shows the very considerable shortening of the long bones. In the affected child the lengths of the humerus and femur were 4·5 cm. and 6 cm. against lengths of



Achondroplasic. Normal.

FIG. 3.

7·5 cm. and 11·2 cm. respectively. The delay in the commencement of ossification centres is also well shown. Whereas in the normal child centres are present for the greater tuberosity and the capitellum of the humerus, and well-developed centres for the lower end of the femur and the upper end of the tibia, in the achondroplasiac no epiphyseal centres are yet visible. It is interesting to note that the width of the bone—i.e., the sub-periosteal bone formation—is unaltered in the two cases.

Two other typical radiological appearances are also visible particularly in the femora, i.e., the tendency to "bowing" of the shaft and the increased width, and more particularly the increased density of the diaphyseal side of the epiphyseal space.

The only skeletal changes visible in mongolism are the shortening of the thumb and little finger—chiefly the middle phalanx, and the delay and irregularity of the formation of the epiphyseal centres generally but particularly in the hand where double and pseudo epiphyses are common. Unfortunately it was not possible to show these changes at so early an age."

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Extreme Hepatomegaly in an Infant. — R. W. B. ELLIS, M.D. (by permission of ROBERT HUTCHISON, M.D.).

A. H., a female infant aged 4 months. Birth-weight 7 lb. 12 oz. Labour induced two weeks after full term; delivery normal. No other pregnancies. Parents unrelated; both healthy. Paternal grandfather died from diabetes; maternal great-grandfather had an enlarged liver (? alcoholic cirrhosis). The infant is breast-fed, and has been free from symptoms. The large size of the abdomen was first noted at the age of 5 weeks (though it is possible that it existed before this time), and has become progressively more obvious, though there has been little change during the past three weeks. The stools and urine have been normal.

On examination.—The infant is not jaundiced, and appears healthy except for the very large abdomen (circumference 18 in.) and slight eversion of the umbilicus. There is a firm, smooth mass extending from beneath the costal margin to halfway between the umbilicus and the pubis and distending the right loin. The sharp lower margin can readily be felt above the pubis. When examined under an anæsthetic (5.10.33), the whole mass appeared to be an almost uniformly enlarged liver, although the left lobe was more mobile than the right. It was not possible to distinguish the spleen. Liver puncture was unsuccessful in obtaining sufficient tissue for examination.

Blood examination (28.9.33).—R.B.C. 4,100,000; Hb. 85%; C.I. 1·03; W.B.C. 12,500 per c.mm. *Differential:* polys. 39%; small lymphos. 42%; large lymphos. 10%; monos. 8%; basos. 1%; reticulos. 3·2%.

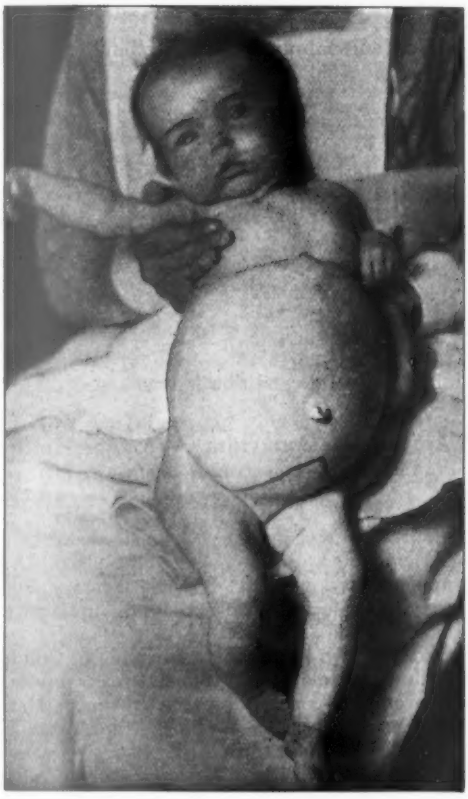
Wassermann reaction negative.

Urine.—Albumin, a trace, reaction neutral, chlorides absent, no bile pigments or salts, or urobilin present. No acetone bodies. No sugar. Few calcium oxalate crystals.

Biochemical investigations (Dr. Payne):—

Plasma albumin 3·12 per cent. (normal 4·5 to 6·7 per cent.).
Plasma globulin 1·14 per cent. (normal 1·2 to 2·7 per cent.).
Plasma fibrin 0·19 per cent. (normal 0·2 to 0·38 per cent.).
Total protein 4·45 per cent. (normal 6·7 to 8·6 per cent.).
Blood cholesterol 120 mgm. per 100 c.c. (normal 100 to 200).
Blood-sugar (after 4½ hours' fast): 0·068 per cent.

Comment.—The presence of a uniform and extreme enlargement of the liver at this age without, so far as can be determined, a corresponding enlargement of the spleen, suggests the diagnosis of either neuroblastoma of the adrenal (Pepper's type) invading the liver, or von Gierke's glycogenic disease. Against the former diagnosis must be placed the fact that the infant is still in relatively good health and free from symptoms, although the condition is known to have existed for at least three months and possibly since birth. In the few cases of von Gierke's disease that have been



Hepatomegaly showing lower border of liver above pubes.

fully investigated, the hepatic enlargement has been found due to a very great retention of glycogen, whilst the author's original case showed enlargement of the kidneys in addition. Attention has also been drawn to the frequent presence of acetone bodies in the urine and the occurrence of hypoglycæmia. The condition may be familial; in the present instance the patient is an only child. No acetone bodies were found in the single specimen examined, but the resting blood-sugar is somewhat low. The possibility of the condition being Gaucher's or Niemann Pick's

disease cannot be absolutely excluded, but is improbable in the absence of unmistakable splenomegaly, whilst a raised blood cholesterol would be expected in the latter condition. Sarcoma or carcinoma are also unlikely diagnoses on clinical grounds, owing to the uniform enlargement of the liver and the absence of symptoms at this stage.

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ADDENDUM.

16.11.33. 2·5 minims adrenalin injected three hours after milk feed.

	Blood-sugar %
Before adrenalin	·088
½ hr. after adrenalin	·110
½ hr. ,, ,, ...	·116
¾ hr. ,, ,, ...	·111
1 hr. ,, ,, ...	·112

17.11.33. 12 grams lævulose given four hours after milk feed.

	Blood-sugar %
Before lævulose	·088
½ hr. after lævulose	·106
1 hr. ,, ,, ...	·110
1½ hr. ,, ,, ...	·100
2 hr. ,, ,, ...	·080

30.11.33. The infant's general condition is unchanged.

Two Cases of Amyotonia Congenita (Werdnig-Hoffmann's Disease).—M. BOLTON, L.R.C.P., M.R.C.S. (for HELEN MACKAY, M.D.).

G. S., female, aged 2½ years.

History.—At 10 months old was brought to a welfare centre following an attack of vomiting and was then noted by the medical officer (Dr. D. E. Mason) to have flaccid lower limbs and absent knee-jerks. Earlier history conflicting: either she had "never kicked freely," or she was a normal child "until an attack of congestion of the lungs at 6 to 7 months old."

When 15 months old attended the Queen's Hospital for Children. Could not then sit up unaided; lower limbs flaccid and extremely weak; upper limbs weaker than normal, but all arm movements could be made by the child. At 20 months had pneumonia which nearly proved fatal on account of weakness of thoracic muscles. Œdema of feet present on several occasions.

Family history.—Mother has had six pregnancies: two healthy children; two died, one at 8 months from pneumonia, one at 18 months after being 10 months in hospital with "rickets" (? amyotonia congenita); one miscarriage.

Present condition.—Weight 26 lb. Well-nourished, healthy-looking, intelligent child. Head held up normally, can sit up when balanced. No contractures. Trunk: thorax normal shape; thoracic muscles acting; abdominal reflexes present. Upper limbs: actively used, though all muscles weaker and more flaccid than normal; forearm muscles stronger than those of upper arm. Lower limbs: muscles extremely weak and flaccid, especially those of thigh. Child uses hands to help lift her legs. Knee- and ankle-jerks absent. Plantar reflex flexor. Fundi normal.

Electrical reactions: responses of all limb muscles weak; most respond to faradism, but the response in some is doubtful.

Skiagrams of lower limbs show slender bones and small muscle shadows.

B. M., female, aged 1 year and 8 months.

History.—At 7¾ months weighed 14 lb. 15 oz.; could hold up head but was unable to sit up at all; lower limbs showed only slight voluntary movements at hip and knee, with fairly good movements in foot. Earlier history conflicting. At 9 months whole aspect limp and helpless, but baby seemed interested and intelligent. During last three months has lost 1¾ lb. in weight; has developed greatly increased weakness of thoracic muscles and contractures of feet.

Family history.—Mother, three pregnancies; first child died in Great Ormond Street Hospital when nearly 2 years old with general weakness, never having been able to sit up; the second child was stillborn. Mother's Wassermann reaction negative.

Present condition.—Weight 18 lb. 9 oz. Thin, fretful child; lies limply. Unable to roll herself over or raise her head. Chest narrow; breathing entirely diaphragmatic. Abdominal reflexes not obtained. Legs a dead weight; small attempts made to draw them up, movement at knees greater than at hip. Inversion of both feet; shortening of right tendo Achillis. Arms, especially upper arms, very weak, though child can pick up and put light objects in her mouth. Grip fair. Right hand weaker than left.

Electrical reactions.—Most muscles of the limbs respond weakly to faradism. Glutei and quadriceps give no response to faradism.

Skiagrams of lower limbs show very slender osteoporotic bones, with small muscle shadows.

There is some doubt as to a distinction between the two diseases. Clinically the distribution of paralysis is identical, all symptoms described under the one name have also been described under the other. The familial history is frequently present in both diseases; and also, in one family, a case has been described under the name of Werdnig-Hoffman and another under amyotonia congenita. Russell Brain refers to the fact that Spiller in 1913 suggested that on clinical grounds these diseases are undistinguishable. Greenfield and Stern have shown that the pathology of the two diseases was identical.

The only apparent difference is that of prognosis—those cases described under Werdnig-Hoffman's disease having a more rapid course and terminating fatally. This does not, however, seem a sufficient reason for separating the two diseases.

Atelectatic Bronchiectasis.—DONALD BATEMAN, L.R.C.P., M.R.C.S. (for DONALD PATERSON, M.D.).

L. B., female, aged 4 years 6 months; nationality, English.

History.—Child has twice been treated in Westminster Hospital during last few months for pneumonia. Reputed to have had other attacks at the ages of 1 year, 3 years (following measles), and twice during last year before coming to Westminster Hospital. This makes six attacks in all. Always been "chesty." Always bringing up phlegm.

Past history.—Has had measles at 3 years old. Discharging left ear since attack of pneumonia, Xmas 1930. No history of blueness or difficulty in breathing at birth.

Present state.—A pink-faced, fairly healthy-looking girl. Looks slightly cyanotic when sleeping. Impaired percussion note, bronchial breathing, and a few rhonchi

at base of left lung posteriorly. Apparently had these signs in 1931 and again when admitted to Westminster Hospital on account of pneumonia in August, 1933.

Investigations.—Mantoux, 1 : 100, negative.

Skiagrams : 14.8.33.—Complete collapse left lower lobe. 11.10.33.—Suggests collapse and bronchiectasis left base. 12.10.33.—(Lipiodol injection.) Left lower lobe collapse—not an accessory lobe. There is bronchiectasis in the atelectatic area.

Enlarged Thymus.—DONALD BATEMAN, L.R.C.P., M.R.C.S. (for HUGH THURSFIELD, M.D.).

B. P., male, aged 1 year 6 months ; nationality, English.

History.—Wheezing sound while breathing since 3 months old, only absent when lying quietly.

Past history.—Has never been ill. Has passed thread-worms.

Present state.—A fat, healthy boy. Wheezing breath-sounds, which are exaggerated by activity.

Investigations.—Mantoux, 1 : 1000, negative ; stomach wash-out for tubercle bacilli: " no tubercle bacilli seen in film or deposit."

Skiagrams.—May, 1933.—Increase of mediastinal shadow, bilaterally, just above the heart. July, 1933.—Shadow much smaller. October, 1933.—Shadow as in May.

Laryngoscopy.—Vocal cords, during brief visualization, apparently normal. Child collapsed, cold, perspiring and cyanotic after laryngoscopy.

? Congenital Laryngeal Stridor. Case for Diagnosis.—JANET ROCKE, M.B., B.S. (for HAZEL CHODAK GREGORY, M.D.).

H. P., female, aged 8 months.

History.—Brought to Royal Free Hospital when 3 months old, because of sudden onset of crowing inspiration two weeks before, associated with slight cough and cold. The child was born in the Royal Free Hospital and was under observation for the first twenty days of life, during which time there was no stridor, although there was a difficulty in getting her to breathe at birth. Deformity of right thumb (deficient metacarpal), and wrist-drop noticed from birth ; otherwise a normal child until three months old.

On examination.—Crowing inspiration with slight recession of ribs.

Throat.—Nil. (Swab negative.)

Chest.—Slight generalized bronchitis ; air entry equal on two sides ; extension of dullness to right of sternum at level of first to second ribs.

Wassermann reaction and Kahn reaction negative.

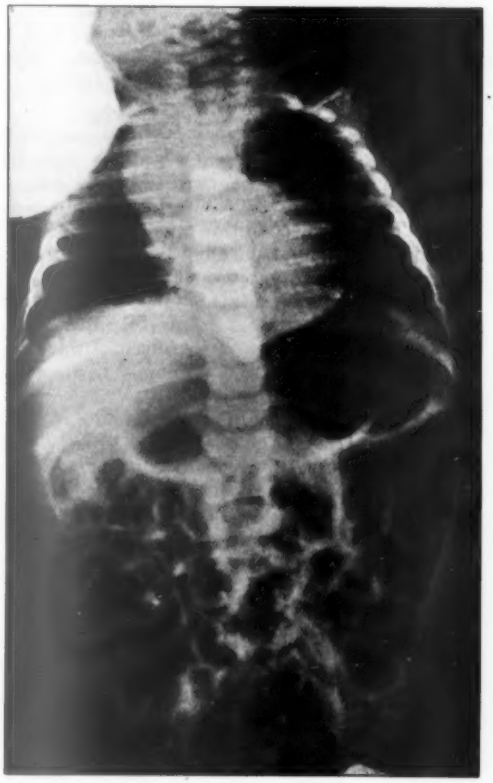
Skiagram of chest.—No evidence of foreign body. Large dense mass in superior mediastinum projecting to right of sternum, ? enlarged thymus. (See figure.)

Direct laryngoscopy. — Marked œdema of larynx, nothing else abnormal seen.

History after admission.—Bronchitis cleared, " crowing " variable in degree, sometimes ceased during sleep. Possibility of enlarged thymus causing symptoms considered, and X-ray therapy on thymus tried ; eight doses have been given and thymus now appears smaller. No alleviation of symptoms to date.

Although X-ray treatment reduced the size of ? enlarged thymus (shadow seen in skiagram) there was no alleviation of symptoms, so a second examination of the larynx was made by direct laryngoscopy on 25.10.33. An actual malformation of the larynx was then seen. Chink of glottis narrowed laterally and shorter

antero-posteriorly. The epiglottis was abnormal and sat over glottis like a cap. Some thickening of arytenoids (? congenital, ? result of associated bronchitis).



H. P. at 3 months. Skiagram of chest.

The case is interesting because of the late onset and associated enlargement of the thymus which apparently had nothing to do with the stridor.

The prognosis is supposedly good, providing the child does not have a severe attack of bronchitis in the near future.

Specimen : Lymphangioma of Liver. — JANET ROCKE, M.B., B.S. (for HAZEL CHODAK GREGORY, M.D.).

P. D., aged 6 months.

Attended Royal Free Hospital Welfare Clinic until 6 months old, and was then brought up with less than two weeks' history of increase in size of abdomen. Large hard smooth tumour filling right side of abdomen, extended back into right loin and one inch to left of mid-line anteriorly.

Laparotomy.—Large firm encapsuled tumour removed from right lobe of liver. Child died under anæsthetic.

Specimen.—Thick-walled ($\frac{3}{4}$ in.) cystic tumour (single cyst) containing clear fluid, size $5\frac{1}{2}$ in. by $4\frac{1}{2}$ in.

Two microscopic sections are suggestive of lymphangioma.

Amyloid Disease in a Patient with Bone Tuberculosis, uncomplicated by secondary infection : treated with liver extract. — H. J. SEDDON, F.R.C.S.

L. G., male, born 1920, was admitted to the Country Branch of the Royal National Orthopædic Hospital on 29.9.30 with tuberculosis of the right foot, and left elbow. The lesion in the foot was closed, but there were several discharging sinuses in the region of the elbow. Skiagrams showed cavitation of the os calcis, but nothing abnormal in the elbow. The general condition was very poor.

1931.—The infection in the region of the elbow was found to be entirely superficial and healed rapidly after opening and curettage of the sinuses. The foot, however, went from bad to worse. The infection rapidly involved the soft parts, numerous sinuses appeared, and amputation through the upper third of the tibia had to be performed in October. In the same year, tuberculosis of the middle phalanx of the right ring finger developed : the infection was extremely virulent and it was necessary to amputate the finger in February 1932.

Early 1932.—Developed tuberculosis of the spine and of the right ilium ; large right lumbar abscess. General condition no better. *In July.*—Signs of amyloid disease appeared—typical enlargement of liver (3 in. below costal margin) and spleen, with albuminuria. There were no sinuses and no sign of secondary infection could be found anywhere. *November.*—General condition definitely better. *December.*—Liver puncture performed. Sections showed advanced amyloid disease involving about three-quarters of the liver parenchyma.

April 1933.—Treatment with liver extract commenced. The equivalent of one pound of fresh liver was given daily for six months (Burroughs Wellcome's extract).

August 1933 (after five months' treatment).—Liver much smaller clinically. A second puncture was performed ; sections again showed amyloid disease, but now involving not more than one-third of the liver parenchyma.

There has been a remarkable improvement in the patient's general condition ; he is more cheerful and brighter mentally, and is taking his food better. The lesions in the spine and ilium have advanced slightly.

The following table summarizes the results of investigations carried out during the course of treatment with liver extract :—

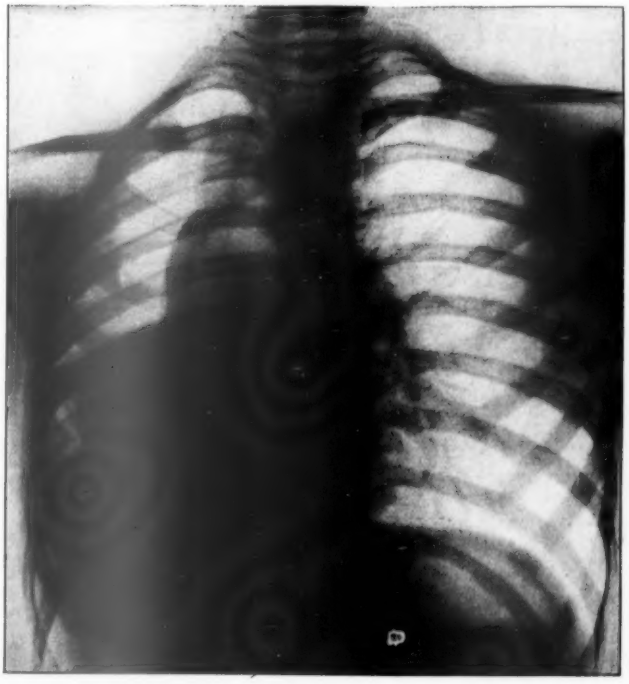
	Before treatment (April 1933)	After treatment (September 1933)	
Blood:—			
R.B.C. per c.mm.	4,700,000	4,380,000	
Hæmoglobin	35% increasing steadily to	55%	
W.B.C. per c.mm.	12,000	10,600	
Weight	66 lb., occasional losses up to 6 lb.	65 lb.	
Kidneys :—			
Fluid intake	Average 58 oz. daily		
Fluid output (expressed as percentage of intake)	76%	90%	
Specific gravity of urine	1010 almost constant throughout	Unchanged	
Albumin	Heavy deposit on boiling. Steady decrease	Nil or trace	
Urea concentration :—			
Before	0·9	1·0	Slight but regular improvement
1 hour after	0·9	1·4	
2 hours after	1·4	1·7	
3 hours after	1·5	1·7	
Blood-urea mgm. in 100 c.c	40 (July)	23 (Sept.)	

Wassermann reaction negative.

Dr. E. A. COCKAYNE said that he had treated with fresh liver a child suffering from amyloid disease of the liver and suprarenal glands and severe secondary anæmia. In spite of a prolonged trial there was no improvement and the child died after a long illness. Involvement of the suprarenals, diagnosed during life by the universal pigmentation of the skin, was confirmed at the post-mortem examination. As in Mr. Seddon's case there was no secondary infection.

Traumatic Pneumothorax with Displacement of the Mediastinum Towards the Side of the Pneumothorax.—WILFRID SHELDON, M.D.

The patient is a girl aged 6 years. Except for whooping-cough in May 1933, she had been in good health until September 18, 1933, when she was knocked down by a lorry. When I saw her about an hour later, she had extensive surgical emphysema of the neck, spreading up over the face and down over the front of the chest. Skiagram taken later that day showed a fracture of the third rib on the right side, and a right-sided pneumothorax.



Pneumothorax with displacement of the mediastinum towards the side of the pneumothorax.

A week later the surgical emphysema had disappeared, and the child was left with a complete right-sided pneumothorax, the right lung being fully collapsed. The heart and mediastinum were displaced about a fingersbreadth to the left.

From then until the present time the air in the pneumothorax has slowly absorbed, until there is now about half the original amount of air. It was expected that coincidently with the absorption of air, the right lung would expand; this has,

however, not occurred to any appreciable extent, although breath-sounds on the right side of the chest are more audible than hitherto. Instead of the right lung expanding, there has been a steadily increasing shift of the heart and mediastinal structures over to the right side—the side of the pneumothorax. X-ray screening shows that the right lung is scarcely expanding at all, and the trachea, which is already displaced to the right, moves further to the right with each inspiration. The movement of the right side of the chest in inspiration is less expansive than that on the left side.

Dr. WILKIE SCOTT suggested that, if after a week or two, the lung had not expanded, the intrapleural pressure should be ascertained and a negative pressure induced. He had found this procedure beneficial in cases of non-tuberculous spontaneous pneumothorax, if carried out after an interval from the onset. In the meantime deep-breathing exercises might be beneficial.

POSTSCRIPT (28.11.33).—A week after the meeting Mr. V. E. Negus kindly made a bronchoscopic examination for me. The trachea and left main bronchus were normal, but the right main bronchus was completely collapsed about half an inch from the bifurcation of the trachea; it did not appear to be inflamed but the lumen was obliterated. Attempts to pass œsophageal bougies down the right bronchus were unsuccessful [W. S.].

Section of Comparative Medicine

President—R. T. LEIPER, M.D., D.Sc., F.R.S.

[*October* 25, 1933]

Helminthology: A Chapter in Comparative Medicine

PRESIDENT'S ADDRESS

By R. T. LEIPER, M.D., D.Sc., F.R.S.

ALTHOUGH our Section is young, the point of view for which it stands is very old. Over one hundred years ago John Hunter wrote:—

"In the course of a variety of experiments on animals and vegetables I have frequently observed that the results of experiments in the one have explained the economy of the other and pointed out some principle common to both."

Comparative medicine, as Dr. Bradley has said, embraces the study of disease-processes in all conditions and with the help of all available means. The physicist, the chemist, the biologist and the physiologist, with no thought of the ultimate application of their discoveries, are daily adding to the store of linked ascertained facts from which the practitioners of human and veterinary medicine take what they need in the exercise of their lawful occupations for the relief of suffering and the prevention of disease.

Our constitution, you will remember, provides that the offices of vice-presidents, council, and secretaries should be filled equally by practitioners of human and veterinary medicine and that the president be elected in rotation from these two branches of medical science. This somewhat rigid organization had as its object the bringing together, at a common centre of discussion, two groups of practitioners and investigators who previously had made few personal contacts.

Every one will agree that on this, the social side, success has justified the means, but after carefully studying the papers and discussions of the past ten years I cannot help wondering if we are yet realizing that integration of medicine, for which Sir Clifford Allbutt urged us to strive, in the opening address of our Section and for which Dr. Bradley subsequently, in 1927, pleaded so eloquently in his address, "What is Comparative Medicine?"[1]

There is a tendency, in danger, I fear, of becoming stereotyped, to invite speakers to deal with the human or veterinary aspects of a subject, according as they are medical or veterinary graduates, and to subdivide comparative medicine into two water-tight compartments. This, I feel sure, is a retrograde tendency. We are perhaps liable to forget that the privileged position which the State confers upon us, either as medical or veterinary practitioners, is only in respect of clinical practice, and that it has not conferred upon us any monopoly in the field of research; although, indeed, we are specially qualified to prosecute research successfully by the wide range of knowledge and the intensive training in minute observation with which our studies have equipped us.

In the study of comparative medicine it is our duty, as professional men, to keep a keen eye on those aspects which may assist in the practice of our professions, but we should not permit our attention to be wholly distracted from larger and more disinterested researches which reveal the great principles upon which the practice of the future depends. With the passage of years and the growing recognition of the fundamental importance of our subject, I hope the Section will see its way to enlarge

[1] *Proceedings*, 1927, xxi, 129 (Sect. Comp. Med., 1).

its membership and further broaden its discussions by the admission of eminent biologists, biochemists and comparative physiologists. At present the membership of the Section numbers 184. Of these 57 are veterinary surgeons, 125 are medical, and only two are non-medical graduates.

Having thus exercised the privilege to which custom entitles me of making some intimate remarks on the affairs of the Section I now turn to some general considerations concerning that branch of comparative medicine which deals with parasitic worms and is technically known as helminthology.

The subject has hitherto received little attention in this Section. By some it is still regarded as a narrow specialism, but there are many indications which point to a growing appreciation of its importance on the part of administrators and of the public. In recent years the sporting community in this country has financed special commissions to investigate "grouse" disease and "partridge" disease. In northern England a considerable fund has been collected for the study of parasitic diseases in sheep. Last year the new Agricultural Research Council appointed a special sub-committee to consider "the helminth parasites of immediate importance to farm stock."

For some years now there has been a professor of helminthology in the University of London, a lecturer in helminthology in the University of Liverpool and in the University of Edinburgh in association with the Royal Dick Veterinary College. Helminthological posts have also been created at the Natural History Museum, at the Veterinary Research Laboratory at Weybridge and at the Institute of Animal Pathology at Cambridge. I must not omit to mention the staff of the Department of Helminthology in the London School of Hygiene and Tropical Medicine, and of the associated Institute of Agricultural Parasitology at St. Albans which is financed by grants from the Ministry of Agriculture.

Turning to the overseas empire in Canada, Dr. T. W. M. Cameron now occupies the Chair of Parasitology which has recently been created in the McGill University at Montreal, and is Director of the Institute of Parasitology at Macdonald College. In South Africa, Professor Mönnig and Dr. Ortlepp hold whole-time posts for helminthological research. In Australia there is similarly a research staff under Dr. Clunies Ross, financed by the Australian Council for Scientific and Industrial Research. In India, helminthology is officially represented by Mr. Bhalerao on the staff of the Muktesar Imperial Institute of Veterinary Research and Dr. Maplestone at the Calcutta School of Tropical Medicine, and in Burma there is an active Helminthological Institute. In China, a department of helminthology is being established in the new Henry Lester Institute for Medical Research at Shanghai.

Moreover, throughout the Empire a considerable number of agricultural and veterinary officers, medical officers, botanists, entomologists, mycologists, plant pathologists and applied biologists frequently undertake helminthological research into special problems which arise in connection with their routine official duties. As an outcome of the Imperial Agricultural Conference of 1927, eight special bureaux for the collection and dissemination of information were established, and of these, one, the Imperial Bureau of Agricultural Parasitology, devotes at present its whole activities to the collation and review of helminthological literature.

Its recent publications enable one to form an estimate of the number of workers and the annual output of papers on helminthology throughout the world. For the year 1930 the Bureau traced 1,092 original papers written by 1,003 research workers and published in 410 scientific journals. In 1931 the numbers traced rose to 1,297 papers by 1,087 authors in 425 journals, and last year there was a further increase to 1,304 titles of papers by 1,171 authors which were published in 477 journals. Of course, many of these papers are not accessible in this country, but it is interesting to add that the Bureau thought worthy of review in "Helminthological Abstracts" 891 of the 1,304 papers published in 1932. These figures do not take into considera-

tion the monographs, dissertations and textbooks which also were published during these periods.

A considerable number of these papers deal with clinical or pathological data, but a large proportion relating to morphology and bionomics are contributed by professional zoologists. This continued activity is a healthy sign, for in the past the solutions of many of the fundamental problems of helminth parasitism of man and the domesticated animals have been reached by zoologists, whose training in comparative anatomy has specially fitted them to undertake these studies. As Leuckart pointed out in 1861 :—

"The relations which obtain between parasites and their hosts are in all respects conditioned by their natural history; and without a detailed knowledge of the organization, the development, and the mode of life of the different species, it is impossible to determine the nature and extent of the pathological conditions to which they give rise, and to find means of protection against these unwelcome guests.

"Even small and apparently isolated facts become often of great significance in this connection, and hence the physician cannot afford to neglect matters which at first sight appear further removed from his department than from that of the zoologist.

"But just as little is it permissible for the latter to forget that the knowledge of the life-history of animals, after which he strives, is to be obtained by the investigation, not only of their organization and development, but also of the position which each species occupies in the economy of nature."

The study of helminthology requires a knowledge not only of the structure and life history of the parasites, but it also necessarily entails a working familiarity with many different groups of the animal kingdom, members of which may act as primary or secondary intermediate hosts for the larval stages and as definitive and reservoir hosts for the adults. Even in the limited field of human helminthology these intermediate hosts belong to the varied groups of insecta, crustacea, mollusca and fishes. For the control of these human infections an acquaintance with their specific characters and bionomics is often essential.

Of the value of comparative zoology I may perhaps be allowed to quote some historical illustrations. Leuckart, professor of comparative anatomy in the University of Leipzig, observed that the embryo of the guinea-worm in man and that of the nematode *Cucullanus elegans* commonly present in the intestine of certain fresh-water fishes were identical in structure and possessed very peculiar characters. He showed that the Cucullanus embryo was swallowed by the cyclops and underwent its later development in its body cavity. On the basis of this striking comparison, Leuckart urged a young Russian naturalist Fedschenko, who was then proceeding to Turkestan, to attempt to infect cyclops with guinea-worm embryos. His experiments proved successful in incriminating cyclops as the intermediate host of the guinea-worm and are the basis of guinea-worm prevention to-day. The second illustration is taken from the life history of the digenetic trematodes. To-day we all know that the redia and cercaria are merely larval stages which occur between the miracidium and the adults in the life cycle of flukes. For many years, however, redia and cercaria were generic names for certain apparently unrelated asexual invertebrates. The rediæ were parasites of pond-snails and the cercariæ were free swimming forms classed among the Infusoria. That the redia had any association with the miracidium which develops within the trematode egg was quite unsuspected until von Siebold, examining the eggs of a trematode from the duck, discovered that in this species the miracidium within the egg-shell enclosed another body which was startlingly like the parasites described by Bojanus in the liver of pond-snails. Earlier von Baer had observed that certain fully developed rediae similarly enclosed tailed bodies which escaped into water and swam about freely. These isolated observations were afterwards brought together by the Danish naturalist Steenstrup and are the fundamental data upon which our detailed knowledge concerning the life-histories of the trematodes of man and the domesticated animals is based.

In the search for intermediate hosts of the bilharzia worms of man I was able, by use of the comparative method, to reduce enormously the investigation of larval stages of trematodes found in naturally infected molluscs. A comparative study of the anatomy of the bilharzia worms with that of other distomes and amphistomes revealed the important fact that the pharynx constantly present in distomes and amphistomes was lacking in the schistosomes. An examination of the cercariæ of known distomes and amphistomes then showed that where the pharynx was present in the adult it was already present in the cercaria. It followed therefore that, of the numerous cercariæ found in naturally infected molluscs, all those having already developed a pharynx could be rejected and the investigation limited to those cercariæ in which the pharynx was lacking. Following the discovery of apharyngeal cercariæ, experimental work proved that the bilharzia worms did, in fact, belong to this small group.

The life history of tapeworms affords a further example. Zoologists and comparative anatomists had observed the identity of structure between the heads of certain adult tapeworms in man and dog, and the contents of strange cysts in the tissues of various domesticated animals. These observations led Küchenmeister to attempt to determine their relationship by feeding to sheep tapeworm segments obtained from dogs. These experiments clearly demonstrated that the cysts were the larval stages of the tapeworm, and introduced experiments on animals as a new technique in the elucidation of disease.

The comparative method is, of course, the means by which our systems of zoological classification are built. Looss in 1899 revolutionized our conception of the relationships of digenetic trematodes by basing their classification on the comparative anatomy of their internal organs. This method was afterwards applied with complete success to the differentiation and classification of nematodes and cestodes.

The diagnosis of helminth infection by an examination of the fæces for ova was first practised by Davaine in 1860. This method has concentrated attention on the minute structure of the helminth egg and a series of careful comparisons has revealed the important fact that the characters of the egg-shell are not merely specific but are also correlated with the generic and sometimes the family characters of the adult.

Biological races.—The morphology of helminths does not, however, suffice in every case to distinguish closely related forms from one another. There are, in some instances, biological races which have become more or less specialized to certain hosts. Thus the large ascarides of man and of the pig are morphologically identical, but it is now generally accepted as a result of experimental work that, under normal conditions, the human ascaris occurs only in man and the ascaris in the pig is a source of danger only to swine. Similarly *Ancylostoma caninum* in the cat and in the dog appear to be two distinct biological races. Another example is found in the tapeworm, *Dipylidium caninum*, of the dog and cat.

In plant parasitic nematodes the prevalence of biological strains or races has assumed considerable economic importance in relation to certain crops. In *Heterodera schachtii*, which causes widespread losses in potatoes and sugar-beet, and occurs on many other crops, there are several distinct races which cannot transfer from one type of host to the other. In his recent book on plant-parasitic nematodes Goodey says that the evidence points to the occurrence in nature of an unspecialized race of this species which is able to parasitize chenopodiaceous, cruciferous and gramineous plants and four well-defined specialized races, each adapted to a limited range of hosts. Thus the potato strain, which is so common in this country, is distinct from the strain on the sugar-beet which has caused great economic losses on the Continent but from which our own sugar-beet has fortunately hitherto escaped.

These modern discoveries open up a wide field of comparative physiology from which many new facts may be culled which have direct bearing on the prevention of helminth disease.

In recent years, as Freund has pointed out, there has been a tendency to over-emphasize the importance of the parasite to its host and to overlook the importance of the host to its parasite. We are apt to forget that the continued existence of the helminths as a group has depended on the survival of their hosts in adequate numbers and that the premature death of a host through the pathogenic action of one species of parasite necessarily terminates prematurely the reproductive life of many other species which may have been causing little harm to that host. It is therefore entirely in the interests of the helminths as a group that their hosts should be as little affected as possible.

In many forms of animal life we find that hosts and parasites live together in harmony and that there is a normal biological equilibrium subsisting between them; the host harbouring a small number of parasites and suffering no ill-effects from their presence. To this condition of peace and amity the host may even make a special contribution, for it has lately been shown that the presence of a small number of helminths may stimulate a physiological response on the part of the host tissues, of a potency just sufficient to prevent the establishment of additional parasites of the same species.

Possibly this physiological response explains, at least in part, that increased natural resistance of the host known as age immunity. On the other hand Sandground has put forward the interesting suggestion that age immunity develops only in those hosts which are not normal hosts but the young of which, not yet being physiologically highly specialized, are invaded by the parasites of another species of host. As the host grows older and develops its specific physiological characteristics it ceases to be suitable ground for their growth and development. A striking example of this is found in *Syngamus trachealis* which, normally a parasite of adult turkeys, causes a heavy mortality in young chickens, but to which they are almost completely immune when they have attained the age of six weeks.

Acquired immunity.—From a previous infestation by helminth parasites there may arise an acquired active immunity in the definitive host. A single infection with *Troglotrema salmincola*, a trematode infection of dogs and acquired by the eating of salmon, gives rise to complete immunity.

Several examples have been recorded of active immunization produced by infestation with nematodes; in the rabbit by Sarles (1930); and in the rat by Africa (1931), and Winfield (1933). Stoll, in 1929, described the development of a marked resistance to later infestation in sheep which have previously been infected with the stomach worm *Hæmonchus contortus*. Rats infected with *Trichinella spiralis* acquire almost complete immunity against a second infection. Fairley, in 1930, recorded an interesting condition which occurred in experimental infections of monkeys with the cercaria of the cattle schistosome, *Bilharzia spindalis*. Although the young worms reached the liver and developed normally they disappeared from the portal system before reaching sexual maturity and conferred on the monkeys a temporary immunity which lasted about three months.

Working with cestode larvæ, Miller has shown that the albino rat, infected with *Cysticercus fasciolaris*, acquires an immunity against further infection. Rats with one or more cysts in the liver could not be hyper-infected, even when fed with a large number of the onchospheres of *Tænia crassicollis*. A similar immunity appears to develop in certain cases of invertebrate intermediate hosts. Cort has recently confirmed and extended Winfield's observation that the mollusc, *Lymnæa stagnalis*, after being infected with the larval stages of a duck trematode, *Cotylurus flabelliformis*, acquires a high degree of immunity. Certain changes are produced in the infested snail which prevent a penetration of cercariæ. With uninfested snails the cercaria

starts to penetrate as soon as it comes into contact with an exposed surface and quickly disappears in the tissue, while a cercaria coming into contact with an already infested snail moves along the surface with a looping movement and soon swims away just as they do when they come in contact with an unsuitable host. Moreover, Cort has shown that a partial non-specific immunity may result, whereby a mollusc infected with the larval stages of one species of trematode may retard or inhibit the growth of the larvæ of another species.

Biological controls.—Vast numbers of helminth eggs and larvæ must be destroyed continually by other organisms. We know of its practical importance in mines where cockroaches and beetles feeding upon human fæces destroy helminth eggs in large numbers. Similarly, on the farm, poultry must play some part, not yet fully assessed, in crushing helminth eggs as they pass through the gizzard, but no one has yet attempted to assess the rôle played by the microscopical fauna of the soil. This is a field which would well repay further inquiry.

Pathological Parasitism.

So far we have considered the zoological aspect of the study of helminths, their morphology, life histories, natural enemies and the normal responses which they induce in their hosts. This we may call the study of "normal parasitism"; in contradistinction to the study of the causes and effects of excessive infestation and the injuries due to helminth migrations which may be termed "pathological parasitism." While those who wish to pursue this study of "normal parasitism" must accept the intellectual discipline of the zoologist, those who desire to study "pathological parasitism" must be prepared equally to submit to the intellectual discipline and training required of the clinician. For in the estimation of the effects of parasitism an intimate knowledge of the other diseases to which the host may be susceptible is requisite.

Helminth parasites, as is well known, do not give rise to successive generations within the same host. Their progeny only become ineffective after they have attained the exterior by one route or another. Under natural conditions this infective material is so widely dispersed and encounters such varied and unfavourable conditions that few succeed in reaching an appropriate host. To meet these hazards the helminths have acquired the capacity to produce vast numbers of eggs and embryos. This fact and the tendency of wild animals to segregate for the purpose of protection or reproduction, or to attain suitable food and water, has led to the occurrence of hyper-parasitism even in wild animals living in open range. Thus the rhinoceros, the zebra and the elephant in tropical Africa to-day are living helminthological zoos.

The protection afforded to game such as grouse and partridge, by the destruction of vermin and the imposition of closed seasons for breeding, leads to a great increase in numbers, a corresponding increase in the contamination of moors and fields with infected fæces and ultimately to intense helminth infestation, although their freedom to range has not been restricted.

The building of a primitive domicile, even of such a temporary character as a bird's nest, tends to form a focus for helminth infection, for Morgan has recently shown that in young starlings which had not yet left their nest, conditions of intense and multiple infestation prevailed.

When man ceased to be nomadic and became a domiciliary animal he also created more favourable conditions for the successful development not only of his own helminth parasites but also those of his dogs and his stock. It is a significant fact that man owes more to his associations with these animals than to his supposed primate ancestry for the helminth parasites he harbours. For these, with few exceptions, are identical with or closely related to species which occur in these domesticated animals. As might be expected knowledge acquired by a comparative

study of the parasites in this little community has been of the greatest service to each, both as regards their prevention and treatment and the understanding of their pathology.

With increase in numbers and segregation, the passage from normal to excessive parasitism tends to follow directly whenever climatic changes and other circumstances favour this attainment of the infective stage by the parasite, and indirectly where conditions are favourable to any increase and dispersal of intermediate hosts.

The conditions which ensure larval development are optimal moisture, temperature and soil aeration. These of course vary for different parasites. Some infective stages are immediately killed by drying: others can stand complete desiccation for weeks. The nature of the soil may have a very pronounced influence on the survival of helminth larvæ, its physical condition being perhaps more important than its chemical composition. Humus, which retains moisture and is of open texture, provides a much more suitable medium for nematode larvæ than heavy clay soil. These soil conditions operate equally in the spread of helminth infection in plants and animals.

Numerous cases could be cited of the effect of an increase in numbers of the intermediate hosts. In Egypt the change over from the basin type of irrigation to perennial irrigation resulted in an enormous increase in the molluscs which spread bilharzia disease and a leap from ten to ninety per cent. in the infection of the population. In Australia, although the cattle there live under open range conditions, worm nodule has in recent times become an important economic problem, yet it is apparently of little consequence in Malaya whence it was probably introduced. Doubtless this remarkable spread of Onchocerciasis is associated with conditions exceptionally favourable to the as yet undetermined host.

Although we know that many hosts can harbour considerable numbers of parasites without showing symptoms of disease, we still lack, unfortunately, definite information as to the number of parasites which a healthy animal can maintain at any one time without the biological equilibrium between host and parasite being disturbed or regarding the normal life-span even of the commonest and best-known forms.

Pathological parasitism develops when the susceptible animal incurs such a massive infection that the normal protective mechanism, to which I have already referred, fails. Such failure may be due to other intercurrent infections or it may follow from a deficient diet. The exact nature of the dietetic insufficiencies has been the subject of recent research by Ackert in America and Miss Clapham in this country. Foster and Cort have shown that dogs which had become resistant to *Ancylostoma caninum* after repeated infection developed severe hookworm disease when placed on an inadequate diet and that a return to an adequate diet led to a loss of worms and their recovery from the disease symptoms. Closely allied hookworm species differ in pathogenicity. It is generally recognized that *Ancylostoma duodenale* is a more severe infection than *Necator americanus*. Some recent work in my own laboratory suggests that even within the species there may be biological strains of very different pathogenicity.

But in addition to these general reactions of the host to helminth invasion there are a number of other localized injuries which may arise from individual helminths, just as in our present-day community, which has now adapted itself remarkably to conditions of modern transport, severe and even fatal accidents may arise alike on the highways and unfrequented by-paths from a variety of unforeseen circumstances. Adult helminths, owing to their strength frequently force themselves into ducts and natural channels of the body, and by their occlusion cause severe damage. They may pierce ulcerated surfaces in the bowel with fatal results. The growth pressure of individual specimens, as in cysticerci in the brain and hydatid in the liver, may cause severe and permanent disturbance of function.

The normal migrations of larvæ and of young adults through the organs of the host *en route* to their final habitat in the body, may cause severe hæmorrhage and destruction of tissue, as in the wandering of the immature liver flukes through the substance of the liver before they enter the bile-ducts, or of the *Cysticercus tenuicollis* from the liver to the mesentery. Severe local lesions may also arise from the abnormal wanderings of parasites which, having entered the wrong hosts, manage to survive. Numerous instances of these have come under the notice of the medical helminthologist. *Fasciola hepatica* may form subcutaneous abscesses. Cutaneous nodules not infrequent in man in the Near East may contain immature specimens of the intestinal nematode *Gnathostoma spinigerum* which lives normally in the intestinal wall of carnivores. Lesions of the skin and of the internal organs result from the unnatural invasion of man by the plerocercoid larva of *Dibothriocephalus mansoni*, while single infective larvæ of *Ancylostoma ceylanicum* of the dog and cat entering the human skin cause creeping eruptions of prolonged duration, and the cercariæ of certain avian trematodes allied to the bilharzia worms have recently been shown to be the cause of intense discomfort to bathers in some of our public parks.

Much remains to be accomplished in the realms of both normal and pathological parasitism, but there has now been accumulated a very considerable body of exact helminthological data which ought to be applied in the field. This transition from the laboratory to the field is always a difficult step, and the student of applied helminthology must not leave entirely to others the practical application of his work until he feels assured that his results are being really effectively used.

"Some Observations on Two West Indian Parasites of Man"

By J. J. C. Buckley.

The nematode genus *Syngamus*, whose name signifies the fact that the male and female worms are in permanent copula, is represented most familiarly by the species *S. trachea*, which causes "gapes" in poultry and occurs also in wild birds.

Until recent years records of the occurrence of *Syngamus* in mammals have been somewhat scanty. Species of this genus, however, are now known to infest the respiratory system of a variety of mammals. In domesticated forms, cattle, goats, sheep, cats, dogs and horses are hosts, and amongst wild animals, species have been recorded in the puma, deer, tiger, hippopotamus and elephant.

The first record of its occurrence as a parasite in man was made in 1913 when a single pair of worms, coughed up by a woman in the West Indies, was sent to Professor Leiper for identification. It was described by him and at the same time he stated that this case probably should be regarded as a purely accidental infection of man by a parasite common in some domesticated animal.

Although apparently of little clinical importance and of rare occurrence in man, the source of this infection is of considerable interest, and in the West Indies last year I was able to obtain evidence which bears out Professor Leiper's theory as to the true source of the infection. While I was examining the nasal cavities of sheep and cats in Trinidad, two species of *Syngamus* were found, which have hitherto been unrecorded from the West Indies. The species from the sheep was subsequently found to be harboured also by cattle and goats, and was identified as *S. nasicola* Linstow, 1899. The morphological resemblance between this species and *S. kingi* is so well marked as to leave little doubt as to their identity, and sheep, goats and cattle are thus incriminated as hosts of this potential human parasite. As to the mode of infection in this human case, little can be said. The life-cycle of none of the syngamids of mammals is known and little appears to have been attempted in this direction. In the case of *S. trachea* in poultry, the mode of

infection from one bird to another is direct, without the essential intervention of an intermediate host. The eggs passed in the fæces develop in the soil and finally hatch, giving rise to infective larvæ, which, on being swallowed by another bird, developed to maturity.

Assuming that a similar life-cycle exists with other species of *Syngamus*, I attempted while in Trinidad, to transmit *Syngamus* to uninfected cats by feeding them with infective larvæ, cultured from eggs dissected out of adult worms, which had been taken from infected cats after autopsy. The results were entirely negative and the experiment was of sufficient duration and extent to warrant the conclusion that an intermediate host probably intervenes in the life-cycle of this species.

The comparative method proved successful in another experiment, which was carried out in St. Vincent, on the life-cycle of *Filaria ozzardi*.

Of the filarial worms which normally infest man, four species are known to be transmitted by blood-sucking insects. In these instances the larvæ are discharged by the adult worms and are found swimming in the peripheral blood of the infected person.

The theory, first postulated by Manson for *Filaria bancrofti*, that such larvæ required an intermediate host to enable them to complete their development in another host, has been verified in the case of *F. bancrofti*, *Loa loa*, *Onchocerca volvulus*, and *F. perstans*. Each of these species has been found to require a particular insect for its successful development. Experimenting in St. Vincent with sand-flies, of the genus *Culicoides*, on natives harbouring *F. ozzardi*, I found that these insects would ingest the larvæ during a blood meal and that the larvæ underwent development in their body in a manner similar to that described with other human filarial worms.

Thus the slender larvæ present in the blood, after being swallowed by the intermediate host, became slightly shorter and much fatter. This stage, known as the "sausage" larva, lives in the thorax of the insect, and in the case of *F. ozzardi* was found there three days after the infective blood meal. In this position it grows larger and develops a rudimentary alimentary canal with mouth and anal openings. Development continues in the thorax and two moults appear to take place, after the second of which the larva has become about three times its original length and about four times its breadth. Eight days after the infective blood meal these larvæ were found to have migrated from the thorax into the head, and by decapitating the sand-fly and pressing gently on the head with a needle the infective larvæ wriggled slowly out of the proboscis.

Thus, with regard to the intermediate host, the life-cycle of *F. ozzardi* resembles that of the other filarial worms, and in particular that of *F. perstans*, for in this case also species of *Culicoides* are employed.

Section of Dermatology

President—HENRY MACCORMAC, C.B.E., M.D.

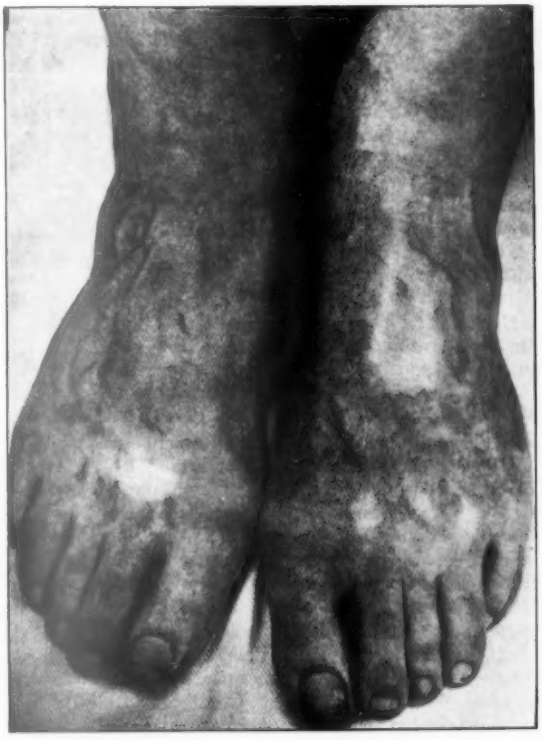
[*October* 19, 1933]

Persistent Erythematous Telangiectatic Condition of Feet, associated with a Congenital-developmental Abnormality of Body-build allied to Arachnodactylia.—F. PARKES WEBER, M.D.

THE patient, W. R., aged 19, is a somewhat lanky, pigeon-chested, scoliotic youth, with a few "striæ atrophicæ" of the skin over his shoulders and groins, such as occasionally occur in connection with rapid growth about the period of puberty without any obvious other causation (cf. F. P. Weber, "Causation of Striæ Atrophicæ Cutis not due to Stretching of the Skin," *British Medical Journal*, 1928 (i), p. 255).

Shortly after a long fatiguing day's walk in 1930 he became severely ill, with what seems to have been venous thrombosis in the left thigh, and about a year later (1931) he had a similar attack in the right lower limb, but less severe and of shorter duration. This second attack occurred whilst he was in a hospital for an ophthalmic operation.

He has irregular mottled patchy erythema (some of the patches are slightly raised) with branched thread-like telangiectases over both feet (see figure), more on



Persistent erythematous telangiectatic condition of feet.

the left than the right foot, and more on the sides than on the back or sole. They tend sometimes to have a livid appearance, reminding one a little of G. Pernet's "persistent lividities" (*Brit. Journ. Derm. and Syph.*, 1925, xxxvii, p. 123). In some respects they remind me also of a case of peculiar redness of the feet in a young woman, whom I showed at the Dermatological Section of the Royal Society of Medicine on March 17, 1932 (*Proceedings*, 1932, xxv, p. 1327), but in the present case there is no oscillometric or other evidence of arterial ischæmia (as there was in the young woman). It should be mentioned, however, that the patient has large dilated superficial veins over the front of the thorax and abdomen, apparently connected with compensatory collateral venous circulation and suggesting that there has been venous thrombosis in the iliac veins, or even in the lower portion of the vena cava inferior. Moreover, the erythematous telangiectatic condition of the left foot developed shortly after the venous thrombosis in the left lower limb in 1930 and the similar condition in the right foot was first noticed shortly after the venous thrombosis in the right lower limb in 1931.

Apparently the patient has been operated for ectopia of the lens or so-called congenitally dislocated lens in both eyes. In his general build he resembles cases of arachnodactylia, which is not rarely associated with congenital ectopia of the lenses. In the present instance the term dolichostenomelia (long slender limbs) introduced by Marfan is obviously more suitable than the term arachnodactylia (spider fingers) introduced by Achard, as the boy is of characteristic asthenic build, with long limbs, but without long typical "spider fingers." His legs have become thicker since the attacks of deep venous thrombosis. Roentgen ray examination shows no disease of the thoracic viscera. Brachial blood-pressure (August 8, 1933): 126/65 mm. Hg. The blood-serum gives negative Wassermann and Meinicke reactions.

I am inclined to think that there is an indirect causal relationship between the boy's congenital-developmental abnormality of build and the venous thrombosis and the telangiectatic condition of the feet. The parents appear to be normally developed and there is no known consanguinity between them, but I have seen the patient's youngest sister, aged 15 years, who has congenital ectopia of the lens and iridodonesis in both eyes, slight spinal scoliosis, lordosis, and a deep depression or "well" in the lower part of the chest, somewhat like "funnel-chest"; her fingers and toes are long, but (like her brother's) not longer than the extreme normal limit. In spite of the absence of consanguinity between the parents I suppose that this familial abnormality might be explained as a Mendelian recessive. The parents have had fourteen children. The patient is the thirteenth and the sister mentioned is the fourteenth. Six others are said to be living and normal. The remaining six died of various diseases.

Sequel to a Case of Polydermatomyositis.—F. PARKES WEBER, M.D.

This is the patient (Mrs. I. F.), now aged 32, whose case I described with Dr. A. M. H. Gray in 1924 (*Brit. Journ. Derm. and Syph.*, 1924, xxxvi, 544-560), as one of "chronic relapsing polydermatomyositis." It should be mentioned that, though the illness lasted a long time and in that sense was chronic, it was nevertheless subacute at the commencement and during part of its course. The patient is quite well at present, and I wish to point out that complete recovery is the normal termination in cases of the kind, if the patient does not die before recovery, e.g., from cardiac involvement or from intercurrent pneumonia, etc. In other words the disease does not become *permanently* chronic, as cases of sclerodermia do. Indeed, these cases differ strikingly from cases of generalized symmetrical sclerodermia, which are sometimes confused with them. (Cf. my case of generalized sclerodermia in a woman, aged 48 years, *Proc. Roy. Soc. Med.*, Clin. Sect., 1931-32, xxv, p. 8; the case had been elsewhere diagnosed as one of dermatomyositis, but the patient had not yet recovered, and any complete recovery seemed very unlikely.)

Generalized Sclerodermia.—H. D. HALDIN-DAVIS, F.R.C.S.

This patient is a man, aged 68, who, two years ago, came to me suffering from sclerodermia which was nearly complete: the greater part of the arms, legs and abdomen was affected; the thorax was less involved but there was a very distinct central area over the sternum extending for some inches on either side over the pectoral muscle. There was, however, no interference with respiration. The face, hands and feet were unaffected. I thought that the prognosis was bad, but after I had taken him into hospital for a few weeks, during which the treatment consisted mainly of colonic irrigation, paraffin baths to the extremities and galvanic current—he also, of course, took the inevitable thyroid, but he has not had any of this for a good many months now—improvement set in and has continued ever since.

Dr. Parkes Weber has shown a case of polydermatomyositis in which the patient recovered perfectly. My patient has not recovered perfectly although his improvement is undoubtedly remarkable. Two years ago the areas of sclerodermia which are still in evidence were much more extensive. The central plaque on the sternum then extended on to the pectoral muscles, the abdomen was much harder, and the limbs were more affected. At that time movement of his knees, which can now be bent easily, was so limited that he was unable to lace-up his boots. Since then his progress has been continued and every time I see him I note an improvement. I hope that in course of time he will be able to disprove Dr. Parkes Weber's dictum that the recovery of these cases is never complete.

Discussion.—Sir ERNEST GRAHAM-LITTLE said he wished to add a comment on the pessimistic view of sclerodermia. Many members would probably remember a case that he had shown before the Section in which there was so pronounced a sclerodermia that the patient had general sclerodactylia, and all the joints were affected, the legs being drawn up at the knee. The patient had to be carried about and fed. She recovered—apparently as a result of having had all her teeth removed—to such a degree that she was able to earn her living by typewriting. The improvement was so amazing that, without seeing the case, one would not have believed it possible.

Dr. HALDIN-DAVIS (in reply) said that he had discussed his case with Dr. Gray, who told him that he too had had a very severe case of sclerodermia in which he had considered the prognosis extremely grave. The patient had, however, to a great extent recovered under the same kind of treatment as that which had been carried out in his (the speaker's) own case.

Leprosy.—Shown by ARTHUR BURROWS, M.D., for Dr. W. J. O'DONOVAN, M.D.

A. D., male, aged 28, engineer.

The patient is English, but was born in India, and lived in Bombay and Madras until 1930.

Between eighteen months and two years ago the patient noticed a "hardening" of the skin and brownness in patches on the legs, which patches eventually peeled. This condition then spread to the arms, back, chest and abdomen, and finally he noticed brownness and swelling of his face. After the pigmentation of the face came the formation of nodules.

Present condition.—Coarse nodulation of face, particularly of muzzle area; coarse brown pigmented maculation of trunk and limbs. Both ulnar nerves palpable and tender. No gross anæsthesia present, but apparently slight hyperæsthesia below and inside each elbow, also some evidence of slight ulnar palsy (left). Large brown macule on right shin has been present and tender for two years. No glands palpable; no ulceration.

Wassermann reaction negative. Swabs taken from nasal mucosa show large quantities of *B. lepræ*.

It is interesting to note the difficulties with regard to the administration of these cases in relationship to the Public Health authorities. Owing to ancient tradition

they are outcast. The public know the condition from which they are suffering, and no suitable arrangement is made for their control. In the present case, of course, the disease is of a straightforward nodular type and the case is shown only on account of its comparative rarity in this country. I would be grateful if any members present could clarify the situation somewhat in respect of the question of treatment. Both in the literature and in the conversation of those we have treated, the evidence of the various forms of treatment seems to be very contradictory, and on the whole not very encouraging.

Discussion.—Dr. H. SEMON asked whether there was any objection to sending this man into a leper colony.

The PRESIDENT said that he had been faced with a similar problem some years ago. A boy, aged 9, born in Brazil, was brought to him with a pigmentary condition, the nature of which had not been recognized during three years' residence in England. He took him into hospital, but he was subsequently transferred to the leper colony in Essex, where he eventually died.

In this country the risk of infection from leprosy was so slight that it could be regarded as almost negligible. It would be remembered, however, that Dr. Dore had shown before the Section some time ago a man who had contracted leprosy in England, and there was at least one other case on record in recent times in which the disease was contracted from contact with an infected individual in Dublin.

Prurigo Nodularis.—G. B. DOWLING, M.D.

The patient, aged 44, has suffered from this condition for years. Numerous circumscribed hemispherical elevations with, in many cases, a rough wart-like summit are present on the extensor aspects of the arms, forearms, thighs and legs. The condition is identical with that which was named by L. Brocq "lichen obtusus corneus," and which is unrelated to lichen planus.

Discussion.—Dr. KNOWSLEY SIBLEY said that he had shown the first case of the disease exhibited in this country; he brought it before this Section in 1916.[1] Since then cases had been shown with the title "? Lichen obtusus," but most were lichen hypertrophicus. The present case he regarded as a typical example, like the one which he had shown.

He agreed that the disease was not associated with lichen planus. No lesions of lichen planus were ever present either on the skin or mucous membranes in these cases.

In the case quoted the irritation had been almost intolerable. The condition had yielded very well to treatment by X-rays. He had used one-half of a pastille dose, repeated at intervals.

Dr. NORMAN BURGESS said that a year ago he had had a similar case in which the lesions were confined to the legs. In this case the irritation, which was intense, disappeared after X-ray treatment, although the appearance of the lesions did not change very greatly.

Rare Type of Xanthoma.—G. B. DOWLING, M.D.

A baby, aged 1 year and 9 months, presents an eruption consisting of a large number of flat papular lesions, ranging in size from a few millimetres in diameter to about a centimetre and averaging rather less than about half a centimetre. They are mainly coffee-coloured but a few of the largest of them are more yellow than brown. Many of them are angular in outline and bear some resemblance in this respect to the papules of lichen planus or flat juvenile warts. They occupy in large numbers the forehead and face and the extensor aspects of the arms, and are present in small numbers on the lower limbs and trunk.

The section shows large numbers of foamy cells in groups among the ordinary connective tissue bundles. The brown colour is accounted for by a dense deposit of melanin in the basal layer of the epidermis.

There is no glycosuria. The blood cholesterol figure is 155 mgm. per 100 c.c. I have never before seen a case of this kind in a baby; the peculiar flat papular lesions are quite unlike the ordinary and more common cases of cutaneous xanthoma.

1 *Proceedings*, 1916, ix (Sect. Derm., 218).

Discussion.—Dr. B. C. TATE said that at a meeting of the Section for the Study of Disease in Children he had shown a similar case,[1] the interesting feature of which was that when the eruption had first appeared, the child had had great thirst and polyuria and the diagnosis of diabetes insipidus was made by a general physician. He (the speaker) thought this might afford a connecting link between cutaneous xanthoma and the Hand-Christian-Schüller syndrome in which xanthomatous deposits occurred in the pituitary region and in the bones of the skull. The mother of Dr. Dowling's patient said that the child had little appetite but wanted large quantities of water. It would be well, therefore, to investigate this case to see whether it was of a similar type to that in the case to which he (Dr. Tate) had referred.

Dr. PARKES WEBER said though the case did not in the least look like a typical example of the rare Hand-Christian-Schüller syndrome (lipoid-granuloma), a few cases had been recorded in which cutaneous xanthoma had been associated with true lipoid-granulomatous changes in the pituitary gland or its neighbourhood, or in the viscera—constituting a kind of incomplete form of the "full-blown" Hand-Christian-Schüller lipoid-granulomatosis syndrome.

Benign Lymphogranuloma—Miliary Lipoid.—G. B. DOWLING, M.D.

This patient, aged 34, has always enjoyed good health and has never suffered from a serious illness. Nine months ago a lump developed on the left side of the nose and another on the forehead; shortly afterwards others began to appear on the shoulders, arms, thigh, abdomen and chest. These continued to appear for several months, until they numbered about twenty in all. As far as she has been able to note no fresh lesion has developed during the past two or three months. She has not noticed any alteration in general health.

The lesions are all of about the same size, that of a large pea, firm granulomata translucent in the centre and softer there than at the periphery. They are found in the regions mentioned. The tonsils are large; there is also definite enlargement of the epitrochlear glands and the spleen. Radiological examination reveals no absorption in the small dry bones. The Mantoux reaction to old tuberculin 1 : 5,000 is negative; the blood-count is normal, there being no relative increase in large monocytes.

She has been having weekly intramuscular injections of sodium morrhuate for two months (3 c.c. of a 5% solution).

So far the lesions have shown no signs of regression, but they have not increased either in size or number.

? Syringocystadenoma ? Apocrine Gland Nævus.—H. W. ALLEN, M.B., for G. B. DOWLING, M.D.

L. R., male, aged 22.

Patient noticed these lesions about six months ago, and is sure they were not present a year ago. One or two came up as pimples, from which he expressed a thick yellow discharge. He thinks that the lesions are spreading slowly upwards and downwards on his chest and abdomen. They are unaccompanied by subjective sensation. There is no relevant past or family history.

Histology.—The section shows tubular epithelial processes in the dermis, apparently dilating to form cysts, and composed of two or more layers of epithelial cells, tending to cornification and degeneration in the inner part.

Discussion.—Dr. W. N. GOLDSMITH said he did not see any reason for regarding the apocrine sweat glands as implicated. He understood the reason for incriminating them was that the condition occurred only in women, and never before puberty; but that was not true, as several cases had been shown in men; in one of his own male cases it had begun long before puberty. Dr. Allen had just remarked that the chest was not a position for ordinary sweat glands. Much less was it a normal position for apocrine glands. Clinically, he, the speaker thought, this was an eruptive hidradenoma.

[1] *Proceedings*, 1933, xxvi, 1546 (Sect. Dis. in Child., 84)

Dr. ROBERT KLABER agreed with Dr. Goldsmith that the section in this case showed no evidence of apocrine gland origin. These cases differed somewhat clinically, but even more in their histology. He had recently had a section from such a case which showed clearly its apocrine origin, some of the cystic dilatations occurring in small apocrine glands. He therefore had no doubt that these conditions could arise from primitive apocrine, though perhaps also from holocrine elements.

Unusual Pigmentation : Case for Diagnosis.—H. MACCORMAC, C.B.E., M.D. (President).

M. J., aged 45. Four years ago what are described as blisters developed on the backs of both hands; these healed in two or three weeks and were followed by dark pigmented areas. Subsequently a similar dark patch appeared under the chin, but without any preceding blister. As seen to-day, all three affected areas are deeply pigmented. The pigmentation is complete on the neck, but on the hands a number of lighter points are included in the patches.

The condition has remained unaltered except that at times there are attacks of pain and swelling of the lesions. The appreciation of touch and of pain is normal.

Sixteen years ago a "tuberculous abscess" developed in the left leg, necessitating amputation, and on two occasions the patient had a perforating duodenal ulcer. He states definitely that no medicine or drug was taken before the eruption appeared.

? Morphœa or Vitiligo : Case for Diagnosis.—W. N. GOLDSMITH, M.D.

W. A., male, aged 29.

Present Condition.—On the back of both lower limbs are a number of depigmented areas of roughly round or oval shape, the largest behind the left knee having a rather jagged or serpiginous outline. Around the central depigmented areas of several of the lesions there is a narrow vivid red border, very slightly scaly and without appreciable infiltration. Outside this there is hyperpigmentation. The pale centre is not obviously atrophic.

History.—Duration, eighteen months. There have been boils on the legs but they did not correspond in position with the present patches. Wassermann reaction negative; a mercury and biniodide mixture led to no improvement. Examination for fungus negative.

Biopsy.—(Sections prepared by Dr. Muende.) That stained by hæmatoxylin and eosin reveals the left half pigmented and the right half free of pigment; slight acanthosis throughout. In the centre are comparatively dense foci of small round cells, particularly round the blood-vessels. The papillæ are dilated and tend to obliterate the rete pegs. Over this zone is some parakeratosis. Further sections have been examined with other stains. Van Gieson and elastin stains show that both collagen and elastin have disappeared in the infiltrated areas. The papillary body throughout stains much less densely with Van Gieson than the rest of the dermis. A silver-nitrate preparation brings out very clearly hyperpigmentation in the basal layer of one half and complete absence of pigment in the other.

Comment.—The diagnosis seems to lie between vitiligo and morphœa. Several observers have described in vitiligo a little inflammatory infiltration histologically and Kreibich has described a clinical inflammatory zone round the edge. But that was only in cases showing dermatitis elsewhere, which appeared to find the edge of the vitiligo vulnerable and the centre immune. I can find no report of vitiligo with a narrow, vivid red border and no inflammation elsewhere. Syphilis seems to be excluded by the negative Wassermann reaction and absence of response to treatment.

Against morphœa is the absence of alteration in consistency.

Discussion.—Dr. I. MUENDE said that there was marked cellular infiltration, above which the epidermis showed acanthosis and parakeratosis alternating with hyperkeratosis. Towards the centre he noticed that the epidermis was thinner. Here there was no pigment in the basal layer, and no evidence of inflammatory reaction, and elastic fibres were absent

from the papillary part of the cutis, whereas towards the periphery there was excessive pigmentation, and the elastic tissue was normal. Therefore it seemed that it was originally an inflammatory condition, which stimulated and then destroyed the pigment function, and as it progressed it destroyed also the elastic tissue. It did not look like typical morphœa.

Dr. PARKES WEBER said that the case much resembled some of the pictures of "porokeratosis (Mibelli)," but he knew nothing of the histological findings in porokeratosis—a condition which had been diagnosed very seldom in England.

Dr. GOLDSMITH (in reply) said he did not think one could diagnose porokeratosis (Mibelli) without the characteristic sharply raised horny wall, with the little ditch along the top of it. The wall in this case was not appreciably raised. He doubted whether porokeratosis caused such marked pigmentary changes or a similar inflammatory infiltration in the dermis.

POSTSCRIPT (27.11.32).—The patient has since been admitted as an in-patient and found to be suffering from a mild but active pulmonary tuberculosis. The intradermic test to tuberculin is, however, negative in a strength of 1 in 5,000. He admitted that he had rubbed the patches, owing to the itching that they caused, and occlusive dressings with Unna's paste led to a strikingly rapid fading of the red borders. Therefore these borders must have been much more sensitive to rubbing than the skin either outside or within them, but it is still difficult to decide whether the condition is vitiligo or morphœa. [W. N. G.]

? Folliculitis decalvans: Case for Diagnosis.—W. N. GOLDSMITH, M.D.

Patient, a girl, aged 14.

Present condition.—There is a large area on the left side of the scalp, circumscribed, but without sharp outline, showing absence of hair, except for a few tufts dotted about. Within this area the skin is pitted and atrophic. There are no obvious follicular lesions and no thickening or prominence. The rest of the scalp is a little scurfy.

History.—The scalp has been very scurfy from birth, but the scales have been almost confined to the area now bald. The baldness was only noticed two months ago, after removing the scurf with a starch poultice.

Comment.—The atrophy points to the baldness having been present much longer than was noticed. The shape of the lesion and the islands of hair are suggestive of folliculitis decalvans or of pseudo-pelade. The scurf is said to have been very extreme and confined to this area: the connection between the two is not clear. The absence of any thickening makes it unlikely to be nævic.

She came to St. John's Hospital in my absence, and the condition was diagnosed as seborrhœa capitis. She was told to use a starch poultice. That removed the scales, and with the scales the hair came away, and has not regrown. It is suggested by Dr. Dowling that the condition is a severe septic process, a kind of impetigo contagiosa, forming heavy crusts, which eventually results in baldness, but not having the characteristic of folliculitis decalvans which relentlessly progresses. The difficulty about that is that it should have been localized to that one region ever since birth. I am assured by a doctor who saw it two months ago that though there were dense scales, there was no trace of impetiginous crusting.

Discussion.—Dr. DOWLING said he thought the alopecia might be the result of a chronic infective dermatitis of the scalp; Sabouraud's impetigo *en nappe*, a chronic dermatitis of the scalp which began as a streptococcal or staphylococcal infection. The case to which he had previously drawn attention was one in which a similar cicatricial alopecia had developed after a chronic dermatitis of the scalp associated with blepharitis of many years' duration.

Dr. ELIZABETH HUNT asked whether the exhibitor had noticed the extensive distribution of keratosis follicularis on the thighs and legs of this patient, and the horniness of the palms. It would be of interest to know the general skin make-up of the patient.

Dr. GOLDSMITH (in reply) said that he would have the Wassermann reaction tested. In answer to Dr. Hunt, he had a feeling that the condition might be of nævic origin; scalp

nævi did not usually lead to loss of hair, and he would have expected the lesion to be thickened. (Dr. SEMON: I have seen a papillomatous nævic condition in a similar position, with loss of hair.)

Urticaria Pigmentosa with Slight Telangiectasia.—ROBERT KLABER, M.D.

This patient, J. M., aged 24, is a tobacconist's assistant. One year ago, small yellow-brown lesions appeared on the outsides of her upper arms, forearms and breasts. They are only slightly or not at all raised and vary in colour. Those on the breast have assumed a reddish tinge suggesting the telangiectatic type of lesion. These lesions appear yellow-brown under glass pressure. There is only slight urtication on rubbing, no irritation and no dermatographia.

Biopsy.—Epithelium: Within normal limits. Corium: Shows marked œdema with dilatation of capillaries and lymphatics and widening of papillæ. There is a perivascular infiltrate consisting of histiocytes and small round cells with a high proportion of mast cells and a few eosinophils. The source of the pigmentation is not evident.

Perl's reaction for free iron, negative.

Urticaria Pigmentosa with Marked Telangiectasia.—ROBERT KLABER, M.D.

This patient, M. G., aged 52, was seen by Dr. Sequeira twenty years ago, when a few brown spots, which suggested freckles, rather suddenly appeared on her chest and upper arms. Ten years ago she had her uterus and one ovary removed. Two years ago the eruption became more extensive and some of its elements assumed a more livid appearance. There is now a widespread eruption covering the trunk and limbs. The distribution is centripetal, only the face, neck, palms and soles escaping. Most of the lesions are macular, or only slightly raised. Urtication on rubbing is slight. The colour varies from pale or dark brown through dusky purple to livid red. The last is most in evidence on the outer aspects of the upper arms where it assumes the appearance of a sheet of reticular telangiectasia. There is no itching and no appreciable dermatographia. "Thread-like and arborescent telangiectasis" of the ordinary type is present on the cheeks and nose and is believed to be of long duration. The general health is good. Wassermann reaction negative. No family history of telangiectasis.

Biopsy.—Epithelium: within normal limits. Corium shows œdema with dilatation of capillaries and a perivascular infiltrate. This consists chiefly of histiocytes, small round cells and red-blood cells with a small proportion of mast-cells. No pigment seen. Perl's reaction for free iron is negative.

This case seems to belong to the same group as those shown before the Section by Dr. Parkes Weber in October, 1930,[1] and October, 1932,[2] and by Dr. Barber in February, 1932.[3]

Comment.—The above two cases show respectively slight and marked degrees of telangiectasia associated with urticaria pigmentosa in adults. Mast cells are much more numerous in the former, less extensive case, than in the latter. In the former case the biopsy was preceded by vigorous rubbing of the lesion.

I wish to suggest that a slight degree of telangiectasis is present in many of these adult cases of urticaria pigmentosa. The presence of a striking degree of this feature, such as is present in the second case, does not really constitute a separate disorder.

Dr. PARKES WEBER said that the more advanced of the two cases (that in the rather obese woman) especially resembled the case which he (Dr. Weber) had described with Dr. Hellenschmied (*Brit. Journ. Derm. and Syph.*, 1930, xlii, pp. 374-382) and the case which he had joined Dr. W. H. Barber in recording in the *International Clinics* (1932, Series 42. vol. iv, pp. 71-76, with coloured plate).

1 *Proceedings*, 1930, xxiv, 95 (Sect. Derm., 1); 2 *ibid.*, 1932, xxvi (Sect. Derm., 6); 3 *ibid.*, 1932, xxv, 1029 (Sect. Derm., 53).

Case shown for Diagnosis as ? Acrodermatitis Chronica Atrophicans and later proved to be Kaposi's (so-called) "Idiopathic Hæmorrhagic Sarcoma."—ROBERT KLABER, M.D.

A patient, male, aged 56, Russian Jew, cabinet maker. The present condition began six years ago with redness and swelling on the backs of his hands. The lesions gradually spread. There have now been for twelve months several circumscribed scaly œdematous areas on the dorsum of both feet and on the lower legs, and the backs of the hands and fingers show an intense erythematous œdema, with similar but smaller discrete lesions on the flexor aspect of wrists and forearms. (Some of these have a white œdematous margin.)

All these lesions have a markedly boggy character and pit on pressure to a depth apparently below that of the normal surrounding skin. New lesions are still appearing. Several plaques on the outer side of the left leg have a cyanotic colour. Two weeks ago a red irregular macular eruption appeared on the trunk. This is now fading.

Patient's mouth shows much dental sepsis with leukoplakia and "smoker's palate." Wassermann reaction negative.

Biopsy from forearm.—Epithelium: Some hyperkeratosis and much pigment in the basal layers. Corium: Marked œdema of the upper-third with dilatation of blood and lymph vessels and a diffuse irregular infiltration with small round cells, histiocytes and fibroblasts. The elastic tissue appears to be scarcely affected. (Weigert).

Comment.—This case is a very unusual one. Clinically it appears to show some of the features of the œdematous forms of acrodermatitis chronica of Herxheimer, or of anetodermia erythematodes, of Jadassohn. The absence of any definite elastic atrophy, however, is against either of these related conditions.

Dr. PARKES WEBER said that he regarded the case as a remarkably fine example of so-called "multiple idiopathic hæmorrhagic (pigmented) sarcoma" (Kaposi), occurring, as the disease frequently did, in an elderly Polish Jew. The patches on the legs of the present case were especially characteristic. In regard to whether that type of the disease (without tumours) could be regarded as a variety of lichen planus there had often been discussion. Microscopical sections should be treated by the Prussian blue method to see whether the pigmentation was mainly due to hæmosiderin.

POSTSCRIPT (by Dr. Klaber).—Examination of further sections shows in the deeper parts of the cutis, beneath the non-specific inflammation and œdema, irregular masses of endothelial cells and spindle-cells surrounding new capillaries.

The iron reaction is negative, but there can be no doubt from these appearances that this case is one of Kaposi's so-called "idiopathic hæmorrhagic sarcoma." The title has therefore been amended accordingly.

Epidermolysis Bullosa.—J. H. TWISTON DAVIES, M.B.

This boy, aged 8, is the only child of parents who are first cousins and who can produce no family history whatever of cutaneous or dental defect.

It was noticed shortly after birth that the slightest trauma produced a blister. At four years of age the hands and ears especially were "one mass of blisters." Not only mechanical trauma but also sunshine, heat and cold caused blistering. His mother brought him to me on account of a large blister on the face acquired that morning at school. The lesions have always healed quickly; there is very little scarring, and what there is is quite superficial and non-contractile. The general physical and mental condition is very good. The big-toe nails are peg-shaped and grow vertically upwards. The teeth are irregularly placed and many of them—notably the upper central incisors—are quite devoid of enamel; the molars are represented by irregular masses of secondary dentine.

Dr. DOWLING said that he had on two occasions seen severe epidermolysis bullosa in the children of first cousins.

Sclerodactylia: Case for Diagnosis.—J. H. TWISTON DAVIES, M.B.

J. R., aged 53, now a publican, was a butcher twelve months ago when the trouble began as a recurrent painful swelling of the second finger of the right hand.

The swelling, which now involves both hands and forearms symmetrically, varies from time to time without obvious cause. At the present time it is not at its worst; when I first saw him in August last the fingers looked as if they were on the point of bursting open at the ends (which indeed they sometimes do) and the skin along the ulnar border of the forearms was œdematous and covered with warty vegetations.

The patient has lost more than a stone in weight, and when I first saw him the fact that he was wearing a collar several sizes too large made me suspect the possibility of a localized myxœdema. The main symptoms are pain, tenderness. and inability to grasp on account of the swelling. Otherwise he feels well. Keeping the arms in a sling does not relieve the condition.

General examination reveals some wasting of the muscles of the thorax and upper arms—possibly disuse atrophy. Sensations of light touch pain, heat and cold are unaltered, tendon reflex increased, abdominal reflex absent.

Blood: Wassermann reaction negative. Blood-count normal. Cerebrospinal fluid normal. Radiological examination for cervical rib and intrathoracic new growth negative.

Report on skiagram of hands (Dr. H. CUBBON).—"The tips of the terminal phalanges of the right second and third finger show evidence of some erosion and loss of bone. There is some abnormal calcification in the neighbourhood of the tips of the terminal phalanges of the left second and third finger, the right fourth finger, and the head of the third metacarpal right."

The symmetry of the condition excludes, I think, a chronic recurrent cellulitis.

Dr. PARKES WEBER said that, from the general appearance and the radiograms, he thought the case was one of sclerodactylia of the hands, with calcareous concretions in the fingers, similar to the case described by R. E. Scholefield and F. P. Weber in the *Brit. Journ. Dermatology*, 1911, xxiii, pp. 276-281 (with figs.). In such cases ulceration might occur, of course, when the calcareous concretions were extruded ("Kalk-Gicht"). The spontaneous absorption of the ends of some of the terminal phalangeal bones was very characteristic of sclerodactylia, but never occurred in any case of thrombo-angiitis obliterans and other kinds of obliteration of arteries, in which, moreover, the soft parts were destroyed before (not after) the underlying bone (fingers and toes).

Gummata of Back.—HUGH GORDON, M.R.C.P.

Patient, male, aged 57. Six months' history of ulceration of the back.

The Wassermann reaction is strongly positive, and considerable improvement has taken place after one week's administration of mercury and iodide. The eruption, however, presents an unusual feature in that it shows a well-marked zosteriform arrangement. In some places there is typical scarring and in others keloid formation. Biopsy on an ulcerated nodule showed the typical histological appearances of gumma.

Section of Ophthalmology

President—A. C. HUDSON, F.R.C.S.

[*October* 13, 1933]

Hypotony after Sclero-corneal Trephining.—A. C. HUDSON, F.R.C.S. (President).

M. E., female, aged 46.

History.—When first seen in July 1933, both eyes had been operated on for chronic glaucoma by sclero-corneal trephining five months previously. The result in the case of the left eye had been perfectly satisfactory, tension being normal, and vision $\frac{6}{6}$, with + 0·25 D. sph. + 0·75 D. cyl. 90°.

In the right eye the fistula had a very thin covering of stretched conjunctiva. Intra-ocular tension was too low to be recorded by tonometer. The optic disc was prominent, and the retina showed innumerable fine dark linear markings suggestive of wrinkles. There was no detachment of retina or choroid. Vision with + 5·5 D. sph. + 0·75 D. cyl. 90° was $\frac{6}{24}$: hypermetropia before operation not more than 0·5 D.

Fluorescein test indicated a microscopic fistula in the conjunctiva covering the corneo-scleral fistula. Attempts have been made to close this by plastic operation.

A point of interest is the presence of the curious dark lines in the fundus, which are, I believe, due to fine creases in the retina, and not of the same nature as the dark lines seen in the fundus after subsidence of a choroidal detachment, the origin of which in collections of pigment epithelium in folds in Bruch's membrane has been demonstrated by Verhoeff.

Discussion.—Mr. T. HARRISON BUTLER said that there might be a danger of late infection in such a case, and therefore every effort should be made to heal the fistula. He suggested that the exhibitor should employ the actual cautery, and then cover up with a conjunctival flap. When Mr. Hudson cured the hypotony, a violent and acute glaucoma might supervene. He (the speaker) had had two or three very low tension cases; one was a delayed union of a cataract incision, and when, at length, healing took place, there was a very acute glaucoma.

Mr. F. JULER said this case reminded him of one of his own. Following a sclero-corneal trephine operation, there was very thin conjunctiva over the fistula, which was leaking, as in the President's case. After three or four weeks the tension was − 3. He dissected up the conjunctiva at the limbus, and scraped away the corneal epithelium in the vicinity, and brought a large flap down, so that the end of the flap came from a point 10 mm. from the limbus. Here the conjunctiva was thick, and he sewed it to the other side. The after-history had been good, for the anterior chamber re-formed, and the tension had become normal. The conjunctiva over the fistula was still rather thick and unsightly, but the swelling was subsiding.

The PRESIDENT (in reply) said that he had tried the metricautery, but he had hesitated to puncture with the cautery. He had experienced difficulty in covering the fistula with a tongue of subconjunctival tissue, on account of the fistula extending so far into the cornea. He had had a case like Mr. Juler's, and had brought a flap over, with satisfactory result.

Staphylococcal Abscess of Sclerotic.—A. C. HUDSON, F.R.C.S.

H. B., female, aged 29, nurse.

History.—Appendicectomy six years ago. Urticaria from food poisoning from June to September, 1932.

May 19, 1933.—Carbuncle of right cheek. No glycosuria.

May 20, 1933.—Right eye became inflamed, and an abscess developed in the sclerotic at the upper limbus, a mass of yellow pus projecting into the anterior chamber. There was intense iritis, practically no fundus reflex, and vision was reduced to perception of light.

May 30, 1933.—Abscess of sclerotic incised. *Staphylococcus aureus* cultivated from pus.

July 15.—Abscess of right side of chin. There are now some posterior synechiæ above with a film of subcapsular lens opacity in their neighbourhood, and some vitreous opacity. Vision with $-$ 1 D. cyl. 30° = $\frac{6}{9}$. No signs of active inflammation.

This case is interesting, owing to its rarity and to the remarkable recovery. I am inclined to regard the abscess as metastatic, but it is possible that infection occurred from the conjunctival sac.

I have seen one similar case in an elderly man who had recently suffered from pneumonia. There was an abscess in the lower part of the sclerotic, a short distance behind the ora serrata, with yellowish fundus reflex and a good deal of vitreous opacity. In that case, as in this, it seemed likely that the eye would be lost, but after incision of the abscess the inflammation subsided, and the patient had good sight.

Cysts in Detached Retina.—A. C. HUDSON, F.R.C.S.

C. M., male, aged 29. Farm worker.

History.—Nothing of importance in family history. General health good. Knows of no illness except tonsillitis for which tonsils were removed five years ago, and defective sight dating from receipt of a blow on the left eye four years ago from a cow's tail. Wassermann reaction negative.

Examination.—Right eye. Vision = $\frac{6}{18}$. The lower part of the retina is detached, the detachment being fairly sharply limited above at about the level of the optic disc, at which level there are choroido-retinal scars. In the most anterior part of the detached retina, near the middle line, are two well-defined retinal cysts.

Left eye. Vision = $\frac{6}{9}$. There is very extensive choroido-retinal scarring.

Mr. Leslie Paton said that he had had a case under observation five years in which the detachment was sharply limited by a choroidal scar, running horizontally. The other eye had no vision, because of a detachment. During all the five years the shape remained unchanged, as if the detachment could not get beyond the scar.

Pemphigus Conjunctivæ.—B. W. RYCROFT, F.R.C.S.

D. R. D., male, aged 55, butcher.

History.—The left eye became irritable two years ago and the right eye six months later. No recent illness; no previous skin trouble; no accident or injury to eyes. No eye trouble in family.

Past ophthalmic history.—No previous eye trouble.

Examination.—Right eye: Upper and lower symblepharon; aberrant lashes Left eye: Symblepharon; pannus; aberrant lashes; no xerosis.

Cultures.—*B. xerosis*: *Staphylococcus aureus.*

Treatment.—(1) Paroleine; (2) extract of Harderian gland; (3) one surface application of radium to each eye (six hours' duration).

Course.—Improvement as a result of radium treatment. Dose: 10 mgm. radium, 1 mm. silver screen; 6 hours.

Discussion.—Mr. TUDOR THOMAS said that the grey patch at the corneo-scleral junction was a feature similar to that in a case of epithelial hyperplasia of the cornea in a tar worker,[1] which he had described before the Section four years ago. The patient had since then been treated by several applications of radium, and each time the patch so treated had cleared up; it had, however, recurred latter. The patient was still being treated. On the last occasion the dose given was 12 mgm. of radium, applied through the lids for four hours. This had resulted in a rapid clearing up of the condition, and the eye had remained well for a time. Though the grey patches seemed similar in the two cases, the pathology was different

Dr. H. SEMON said that the pathology of the two conditions, pemphigus and hyperplasia—probably of epitheliomatous character—was entirely different. Benefit in the latter might be expected, but there seemed no reason to expect radium to effect improvement in pemphigus. The improvement here seen was probably due to absorption of fibrous tissue formed in the healing of the two surfaces. He did not think that radium could possibly check the progress of the disease.

Juvenile Macular Exudative Retinitis. (? Type I Coats)—B. W. RYCROFT, F.R.C.S.

G. C., aged 14, schoolboy.

Present complaint.—Defective vision of right eye, noticed three years ago—sudden onset. No pain.

Past history.—No injury; no recent illness.

Family history.—Negative.

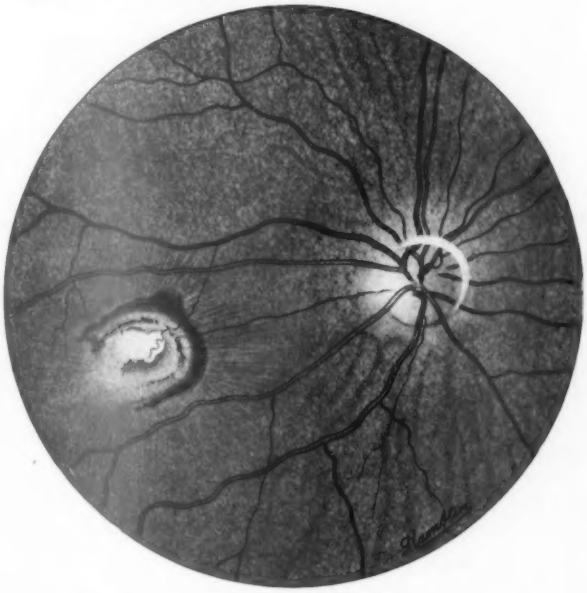


FIG. 1.—3.2.32.

Fundus report: January, 1932.—Two paracæcal superficial hæmorrhages. Hazy disc. Macular condition shows increasing lines of tension but is otherwise unchanged. Retinal vessels: nothing abnormal discovered. Tension normal.

Fundus report: June, 1932.—No hæmorrhages. Lines of tension less. Small hæmorrhages along inferior temporal vein.

1 *Proceedings*, 1930, xxiii, 288 (Sect. Ophthal., 20)

Investigations.—Wassermann reaction negative. Blood sedimentation rate normal. Mantoux test negative. Blood-count, normal.

Present fundus report.—Right eye: Crateriform pale mass in right macular area with areas of dense pigment. No hæmorrhages: no vascular dilatations. Papillo-macular atrophy of the disc. Left eye, negative.

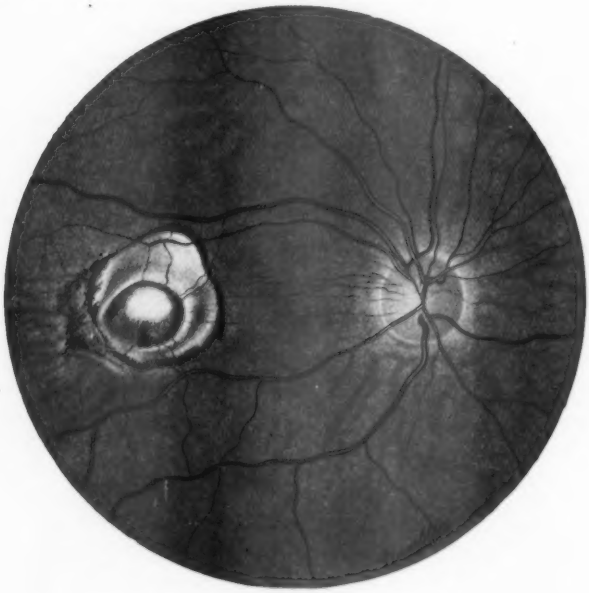


FIG. 2.—13.12.32.

The diagnosis is controversial. All examinations are negative, there is no history of trauma, and the hæmorrhages would exclude the presence of a congenital hole; also the onset of the condition is definitely remembered by the patient.

Melanotic Sarcoma of the Ciliary Body.—B. W. RYCROFT, F.R.C.S. (by courtesy of Sir STEWART DUKE-ELDER).

M. A. H., female, aged 55.

History.—"Speck on white of left eye noticed eighteen months ago." A second "speck" noticed one week ago. No recent illness; weight maintained.

Past ophthalmic history.—No ocular pain or discomfort. No deterioration of vision.

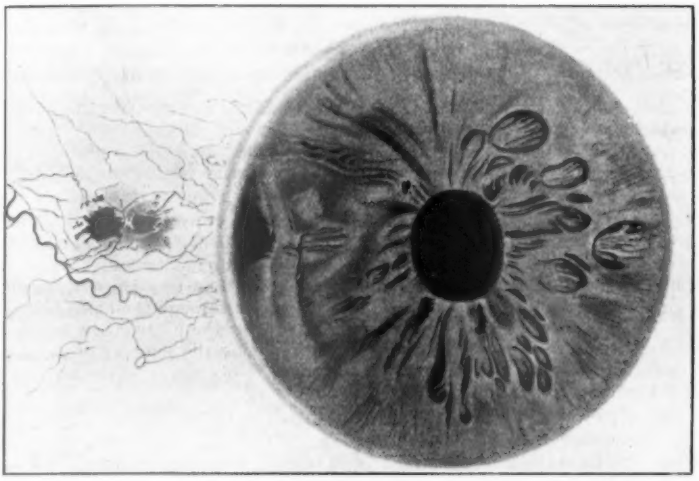
Family history.—Negative.

Examination (left eye).—Small, heavily pigmented growth invading angle of anterior chamber at 9 o'clock. Iris pushed inwards and pupil distorted. No lens tilt; accommodation equal, right and left. Two small clumps of pigment in region of anterior scleral vessel; perforations over internal rectus. Several scattered melanomata in skin of forehead and back.

Vision:—Right, with correction, $\frac{6}{6}$ Ji; left, with correction, $\frac{6}{6}$ Ji.

Fundus.—Corresponding pigmented protuberance can be seen behind the iris.

Urinalysis: Melanin present.



Melanotic sarcoma of the ciliary body.
(From a drawing supplied by Messrs. Hamblin.

An additional note from the family doctor states that the liver is not enlarged nor can he detect anything abnormal in the chest. But he finds there is melanin in the urine, and the patient has multiple pigmented moles and patches all over the body.

There is a difficulty in deciding whether the melanomata in the skin are secondary, or whether this is a case of malignant change in a pre-existing melanoma of innocent nature, of which parallel types are present in the skin.

Familial Occurrence of Microcorneæ Associated with Brachydactyly.—T. TIZZARD, M.B.

S. P., male, aged 53, admitted to the Royal Eye Hospital, June, 1933, on account of corneal ulcer of the right eye.

Present condition.—Patient is thickset, broad-shouldered and of small stature, height 4 ft. 11 in. His hands are short and broad and the fingers are short even in proportion to the rest of hands. His feet are likewise small: he takes size 5 in boots. His corneæ measure 10·5 mm. in both vertical and horizontal diameters. The average normal corneal diameter is 11·4 mm.

Family history.—The patient is one of 15 children, 14 being male. No definite information about the other members can be obtained. The patient has one child, a boy aged 8 years. His general features are like those of the father—small, broadset, with brachydactylous hands and feet. His corneæ also are of low diameter, 11 mm. (The cornea is fully grown at the age of 6 years [Priestley Smith], or 5 years [Kayser].)

Comment.—Familial occurrence of brachydactyly, as also microcorneæ, is well known. The association of the two does not seem to have been recorded.

I have to thank Mr. Arnold Sorsby for his help and interest in the two cases.

Ruptured Globe, with Cataract.—O. GAYER MORGAN, F.R.C.S.

Patient, a woman, aged 59, had four years ago a blow on the eye. She took no notice of this, but in February last her sight began to fail, and when I saw her, a week ago, she had a mature cataract. Tension is normal and projection is good.

The question is as to how to remove the cataract. There is a very large staphyloma, presumably mostly of iris, just above the cornea, and the pupil is pulled to the upper part of the eye.

The methods which occurred to me are: (1) Extraction from above with a corneal section; (2) Extraction from below with iridectomy; (3) Repeated needling of the upper part of the lens. The second method appears to be the most satisfactory.

Discussion.—The PRESIDENT agreed that it was difficult to know what to do in this case, for if a cataract section were made near the staphyloma, disaster was likely to result. Couching was attended with considerably greater risk when the vitreous was solid than when it was fluid, and in this case, as there was no means of ascertaining the consistence of the vitreous, the operation was in his opinion not advisable.

Mr. J. FOSTER said that he had seen a description of an operation which would seem to be suited to Mr. Morgan's case, although it was originally designed for an uncomplicated cataract extraction. The approach to the eye was made by raising a flap of conjunctiva at the outer side as far as the corneo-scleral junction. A keratome incision was then made into the anterior chamber at this point and the lens expressed through the corneal opening thus made. In Mr. Morgan's case, after the opening was made, the pillar of the iris inclusion on the side nearest the incision could be divided, thus reducing the chances of the pupil being dragged upwards, which complication would almost certainly ensue if the ordinary corneal incision for a cataract extraction was made.

Mr. LESLIE PATON said that the operation referred to by Mr. Foster had been described in full by Jacqueau (*Bull et mém. soc. franç. d'Ophtal.*, 1931, xliv, 395). Jacqueau removed the lens from the side by means of a vertical keratome incision. He ascribed to Junès (of Sfax) the first invention of the method, but it was actually suggested by Daviel.

Mr. R. FOSTER MOORE said that if this case were his, he would dissect the conjunctiva carefully off the staphyloma and so expose the prolapsed iris, define cleanly the edges of the ruptured sclerotic and put a stitch in them ready to tie before cutting off the iris. He would then cut off the iris, having isolated it especially along the edges where it was in contact with the sclerotic, tie the scleral stitch, and then pull the conjunctival flap down over it.

He had been surprised to find how little the iris in such cases had become incorporated with the adjoining tissues, even after a long period, and how relatively easy it could be isolated and defined by delicate dissection.

Tubular Spectacles.—LESLIE PATON, F.R.C.S.

In some cases of very defective reading vision in old people, I have found that distinct improvement can be obtained by concentrating the vision by means of tubes set in a frame, to shut off all extraneous light. As I have been trying these for a few months only, I have not yet had much opportunity of discovering in what particular type of case they are of greatest benefit. The following is one instance where benefit has been received.

Male, aged 65. Extensive choroido-retinal degeneration, vision reduced to within 10° of fixation-point and central vision $\frac{6}{24}$ in the right eye and less than $\frac{6}{60}$ in the left. His reading vision has so much improved that he is now able to read his own letters and he has ordered nine pairs of the tubes.

Other cases are mainly cases of cataract where the improvement has been from J. 8 to J. 2, and from J. 12 to J. 1.

It is unfortunate that, though Pepys, in his Diary, records that in 1669 he was having a pair made for him ("my vizard with a tube fastened in it"), the Diary ceases without any record as to whether they helped him or not.

Depth Perception Test.—RANSOM PICKARD.

This test is designed to test one-eyed persons, or those in whom one eye is useless for vision. It consists of a cork dinner-mat 8 in. in diameter, covered on one side with black velveteen. On this side are stuck thirty or any other convenient number of pins, ranging in length from $2\frac{1}{2}$ in. to $\frac{3}{8}$ of an inch. On the blunt free end of each pin is fixed some sealing-wax of differing colours, easily distinguished from one another. Those actually used were: yellow, 6; red, 6; green, 6; dark blue, 6; white, 6; = 30. The colours were distributed over the different-lengthed pins.

The test was employed thus: The examiner held the disc upright 2 ft. in front of the examinee, who was given a full-length lead pencil. Holding this in his working hand, usually his right, he was told to touch all pins of a particular colour, e.g., red, with the blunt end of the pencil, keeping his head still. This was repeated with each of the five colours, the number of hits for each colour was noted, and the numbers were finally added together.

From testing a number of one-eyed persons who were able to carry on their avocations successfully, it was found that twenty-five hits out of a possible thirty were usually obtained; this was taken as a standard. If the examinee obtained this number it was assumed that his depth-perception was normal. To score a hit the head of the pin must be hit fairly; a glancing blow does not count.

As far as the examinee is concerned, the test is a colour test; to the examiner it is a depth-perception test. If by chance the examinee is colour-blind, this does not matter; his hits and misses are counted as usual. Of course no hint of the real object is given to the examinee, otherwise the malingerer would score misses all the time and the neurasthenic would reveal his neurasthenia rather than his depth-perception.

The real difficulty of those who have recently lost an eye is in the antero-posterior dimension; in the lateral and vertical dimensions the sensations from the external ocular muscles plus movements of objects over the field are sufficient guides. It is for this reason that the examinee's head is not moved and that he moves the pencil directly towards the pin-head and not slantwise. He must not hold the disc.

The apparatus is simple and cheap to construct. It could be varied by a greater variety in the length of the pins and in the kind of weapon used to hit the pin-heads. But, if any variation is made, it is important to obtain the average proficiency by testing one-eyed people who are known to be carrying on craft occupations successfully.

Acute Lupus Erythematosus, with Fundus Lesions.—H. C. SEMON, M.D. and EUGENE WOLFF, F.R.C.S.

I.—Dr. H. SEMON.

Notes on the Skin Condition.

The patient, E. L., a woman aged 26, was first seen by me in consultation, on May 11, 1933. For six weeks she had had rheumatic pains in the shoulders and limbs, treated by the family doctor with salicylates which had alleviated the pains and checked the mild pyrexia accompaning them. A fortnight before I saw her she had left her bed and sat in the garden in the sunlight, which was exceptionally bright for the time of the year. She exposed her face, neck and chest for about four hours. On the following and subsequent days there was pronounced redness, with burning and irritation on the parts exposed. This was regarded as a rather severe type of sunburn, and that it did not subside was the reason of the consultation. A pronounced raised dusky erythema on the parts above described, and sharply demarcated on the chest by the V-outline of the blouse, made it quite evident that exposure to sunlight had been at least a factor in production, although it did not explain its persistence. A guarded prognosis, with the added suggestion that the case might be an incipient acute lupus erythematosus, was justified by her admission to hospital with well-marked symptoms of that grave disease, a fortnight later (May 25). Throughout the subsequent course there appeared almost daily, fresh patches of infiltrated dusky erythema, on the backs of the hands, the trunk, and the lower extremities, on which in particular a purpuric tendency, and even necrosis, rapidly developed. Mental irritability varied with a state of somnolence, there was pronounced gingivitis with bleeding of the gums, a rapid pulse, and a septic type of temperature (100-104° F.). A blood-culture and one from the catheter specimen of the urine were negative.

A blood-count on June 13, evidenced some degree of leukopenia—4,000—which had fallen to 3,000 a month later. There was no albuminuria at first, but this developed on July 2, and increased the gravity of the outlook. In view of this, I obtained permission for a consultation with Dr. A. C. Roxburgh who had recently published the notes of five very similar cases in the *British Journal of Dermatology and Syphilis*. He was in full accord with the diagnosis and feared an ultimately fatal issue. About this time the patient complained of misty vision, which on inquiry was found to have been present before her admission on May 25. The cause of this symptom, which was quite new to me, was revealed by Mr. Wolff on retinoscopy, and is the basis of a communication which we believe to be original.

No treatment proved of the slightest avail in stemming the progress of the disease. Small injections of a gold preparation, nucleonate of soda, and eventually (when the symptoms suggested a general septicæmia) anti-scarlatinal serum, had no beneficial effect whatever, and with the signs of a bronchopneumonia, the patient died in coma on July 18. A post-mortem examination was refused and was not urged because the findings in this disease are nearly always the same, and resemble those met with in death from acute septicæmia.

The ætiology of acute lupus erythematosus is still unknown although there are some authors who believe that tuberculosis may play a part, while a streptococcal causation also has its advocates. The acute variety with its generalization of infiltrated œdematous, bullous or hæmorrhagic patches does not much resemble the "butterfly" patches of the chronic type, and yet the chronic sometimes passes spontaneously into the acute or may become so by injudicious therapy, of which ultra-violet light, some acute infection, or the application of caustics may be cited. The influence of light in the causation in this case seems to me rather more than a coincidence. There was no skin trouble at all previous to the well-defined and prolonged exposure to direct sunlight, which would appear to have "sensitized" her skin to some toxin or bacterium, which may well have been of streptococcal type. Several such cases have been previously reported and the associated gingivitis has also been noted on more than one occasion, but is by no means invariable and cannot therefore play a leading role in the causation. There does not in fact appear to be a single constant symptomatic feature or concomitant in this peculiar disease—except the skin manifestations—which would give us a lead in ascertaining the ætiology or instituting a rational line of therapy.

II.—Mr. Eugene Wolff.

The Ophthalmoscopic Appearances, with a Pathological Report.

I first saw the patient on June 12, 1933—that is, five weeks after the onset of the skin affection. She had complained of some slight mistiness of vision.

In the right fundus there was a round, slightly raised area, whitish in colour, rather less than a quarter the size of the disc, situated on its nasal side, and about a disc breadth from it. A retinal vein passed over the lesion and by its bending emphasized that the patch was raised above the general level of the retina.

The lesion differed from a miliary tubercle of the choroid, which it somewhat resembled, by lacking the yellowish colour and the usual oval form of the latter, also I thought it was more raised.

At this period there was no albumin in the urine. A terminal albuminuria appeared only some weeks later (on July 2).

The lesion was seen at intervals till the patient died. It enlarged slightly at first, but otherwise showed little change.

Similar lesions appeared in the left fundus and two smaller areas formed in the right eye above the disc (fig. 1) during the last week of life.

The edges of the disc became slightly blurred, but there was no actual swelling. Also, I thought, the veins became more engorged.

Vitreous opacities were looked for but not seen. It is, however, quite possible that fine opacities were missed, as examination of the fundus—owing to the condition of the eyelids, &c.—became rather difficult.

The patient died at 10.25 p.m. on July 18, and as no general post-mortem was allowed, the posterior portion of the right eye was removed from the front next morning.

As I can find no mention of the method, it may perhaps be of use to describe it shortly. A speculum was put in and the conjunctiva divided along the whole of the lower fornix (on another occasion I should incise the upper fornix) and dissected off the globe. All the muscles were divided except the external rectus. The optic nerve was severed and the eye drawn forward by traction on this. The posterior portion of the eye could then be quite easily removed. The anterior portion was

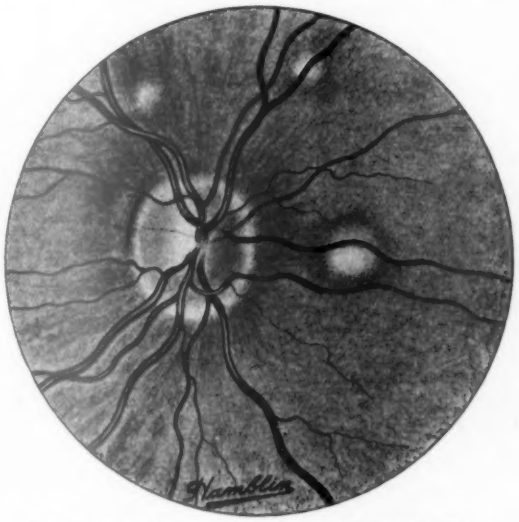


FIG. 1.—Acute lupus erythematosus with fundus lesions.

replaced and a few stitches were put in the conjunctiva. With this method it requires close inspection to see that anything has been done.

The posterior portion of the eye was fixed in 10 per cent. formalin and embedded in celloidin.

After a number of sections had been cut, it was removed from the celloidin, embedded in paraffin, and stained for tubercle bacilli and other organisms, but none were found.

The section showed a fairly generalized slight invasion of the choroid with inflammatory cells.

At the site of a lesion (fig. 2) there was a well-marked subretinal exudate containing inflammatory cells (lymphocytes, a few polymorphonuclear leucocytes a few large mononuclears), some pigment, some spindle cells and capillary vessels (fig. 3). The last, no doubt, indicated the conversion of the exudate into granulation tissue. Two small breaks in the pigment epithelium were found deep to the exudate.

There was no evidence of tuberculosis.

Apart from the post-mortem changes, one could not be sure of any pathological changes in the retina.

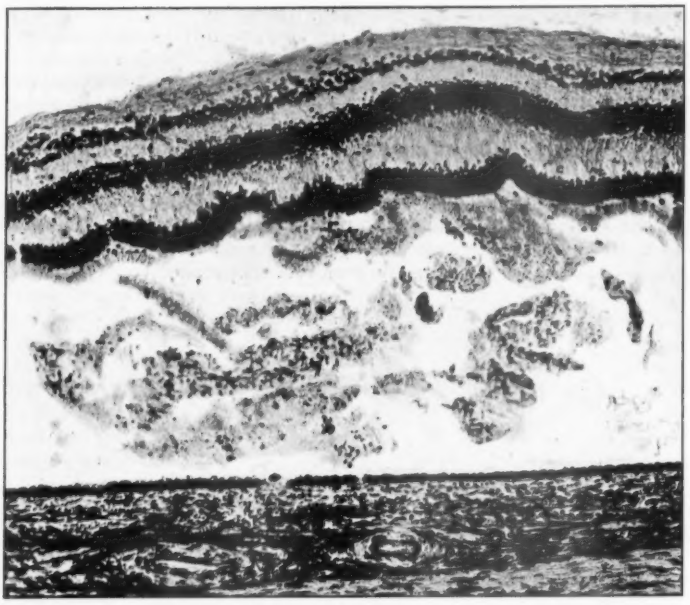


FIG. 2.—Section of the retina and choroid and the exudate between them.

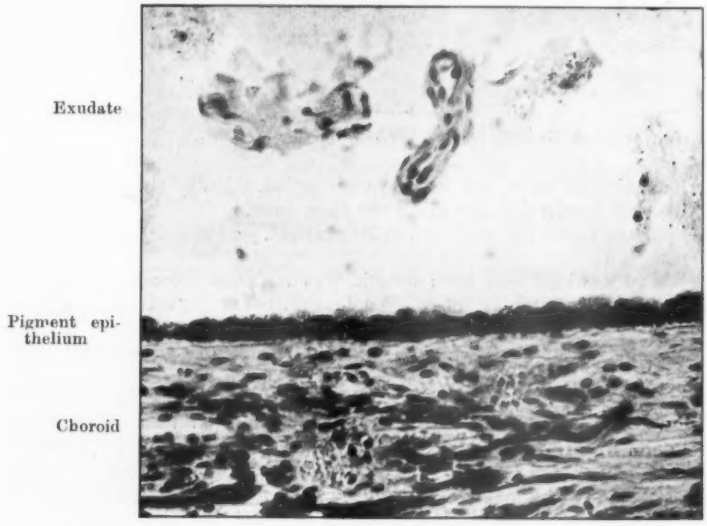


FIG. 3.—To show a new-formed capillary (under higher magnification) in the exudate between choroid and retina.

The fundus condition then appears to be the result of a choroiditis with localized subretinal exudates.

So far as we are aware no fundus lesion has previously been recorded in the acute "septicæmic" form of lupus erythematosus.

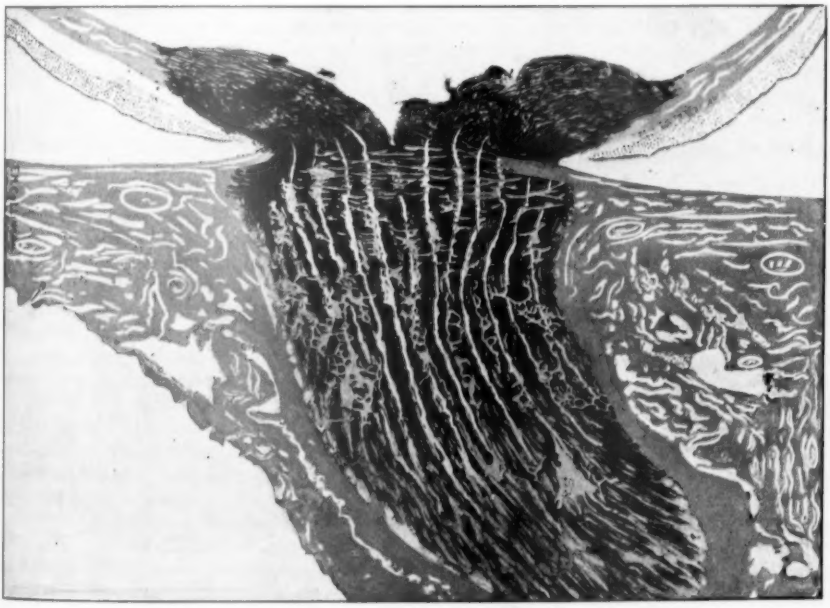
Abromowitz and Dulewicz, however, describe fundus lesions in a less fulminating form of the disease.[1] These consisted of small spots whose colour was lighter than the rest of the fundus, situated principally at the macula, but also around the disc. They gave the appearance of being shallow cavities. The authors state that the lesions reminded them of the "retinitis guttata" described by Dimmer in arteriosclerosis and in other conditions whose ætiology was not clear. Their patient also when first seen was pregnant, and the number of spots varied with the general condition, especially with the amount of œdema. There is no note as to whether albuminuria was present or not.

In our own case the fundus lesions no doubt formed part of the "septicæmic" condition, and one would suggest that, like miliary choroidal tubercles, they probably represent a terminal stage of the disease.

A Note on the Normal Medullation of the Optic Papilla in the Dog

By Eugene Wolff, F.R.C.S.

In a paper entitled "A Contribution to the Pathology of Papillœdema,"[2] Dr Francis Davies and I discussed the normal anatomy of the optic "papilla" in the dog, and showed that it differed in so many ways from that of the human that unless these facts were realized it was very easy to misinterpret the results of experiments.



R = Retina. S = Sclera.

Normal optic nervehead in the dog, stained with Weigert-Pal. Note that the fibres of the disc and in the region of the lamina cribrosa are medullated.

1 *Ann. oculistique*, 1933. 2 *Brit. Journ. Ophth.*, 1931.

We found, for instance, that if the eyeball of a living dog be removed, divided equatorially and the vitreous taken out and then the optic nerve-head examined with a loupe or, better, with a slit lamp, the edge of the disc is seen to be markedly irregular, with short whitish processes extending centrifugally from its entire circumference, giving the frayed appearance of opaque nerve-fibres.

Also, it was found that when the disc was examined in the intact animal with the ophthalmoscope, its edge was normally not sharply defined, a fact already noted by Schieck.

In order to discover the reason for these curious phenomena, six normal dogs' eyes were, after remaining in bichromate solution for six weeks, embedded in celloidin and stained with Kulchitsky's modification of the Weigert-Pal method for demonstrating opaque nerve-fibres.

All the eyes showed that the nerve-head in the dog is, in fact, medullated. Moreover, unlike what obtains when opaque fibres occur in the human, they do not lose their medullary sheath even in the region of the lamina cribrosa. The medullation extends to the edge of the disc and involves the whole of it (see fig.).

It is of course well known that medullated fibres such as occur occasionally in man are often present in the dog, but the fact that they occur even in the region of the lamina cribrosa and that the fibres corresponding to the whole disc are medullated has, I believe not been recorded before.

Section of Medicine

President—Sir FARQUHAR BUZZARD, Bart., K.C.V.O., M.D.

[*October* 24, 1933]

DISCUSSION ON THE EARLY DIAGNOSIS OF PULMONARY TUBERCULOSIS

Dr. William Stobie: Early recognition of any morbid process depends largely on an accurate knowledge of its mode of production and development.

Notwithstanding the widespread incidence of tuberculosis of the lungs and the amount of research that has been carried out, experimentally and otherwise, we are still far from a satisfying conception of the pathogenesis of the disease. On hardly a single point is there anything like general agreement. As a result, we have a mass of literature which threatens to become overwhelming.

Even now, fifty years after the discovery of the causative organism, there is sharp division of opinion as to the portal of entry of the bacilli and the route by which they finally settle in the lung tissue, there to initiate the tuberculous process, as seen in adults. Obviously, early diagnosis would be facilitated if we were in possession of undisputed facts.

It is commonly acknowledged that in the vast majority of cases an initial infection occurs in early childhood by way of the air passages. Consequent on this, there appears, somewhere in the lung, the primary lesion, the tubercle of Parrot or Ghon. And it is not disputed that this primary focus generally undergoes a healing process, although not until the associated tracheo-bronchial glands become infiltrated. From this point disagreement begins.

How far, for example, can these children be regarded as immune to the phthisis of adult life? An enormous percentage of children, we realize, are "infected" and yet those of us who have watched these children over a long period of years know that they rarely come under our notice as cases of "consumption."

Again, what part, if any, do the intrathoracic glands play in the production of adult phthisis? We have proof that they may remain for years full of bacilli, and therefore, presumably, a potential source of infection. Actually, in practice, we regard them as such in the secondary lesions occurring, for example, in the eye. But any suggestion of a retrograde spread along the lymphatics, or an extension by contiguity, is looked upon with disfavour. An attempt to demonstrate such a possibility on a skiagram is lightly dismissed as erroneous interpretation.

The theory of air-borne re-infection holds the field for the time being. In the absence of a roundabout explanation of hæmatogenous or lymphatic distribution, it would be interesting to hear from the exponents of the prevailing view, the explanation of the nearly simultaneous involvement of cervical glands and of the lungs in certain instances. Such cases appear to be met with more frequently now than formerly, and, incidentally, seem to have lost their reputation for being highly resistant to the ravages of the bacillus.

But disregarding the various theories of spread, it is clear that in making use of the term "early diagnosis" we ought to mean the recognition of the primary focus in children. Having detected these lesions by wholesale radiography, what is to be done with the vast numbers of discovered cases? Apart altogether from the practical impossibility of finding sufficient institutional accommodation for them, we know from experience that they get along very well without treatment, and only occasionally develop clinical tuberculosis.

My remarks, therefore, will be confined to the early diagnosis of pulmonary tuberculosis in adults. If we accept the modern conception of the pathogenesis of the disease, this, in actual fact, means the recognition of the disease in the first stages of tertiary infection.

Complaints are frequently made by sanatorium superintendents that patients are too often sent to them in a late stage of the disease, and there is an inclination to blame the general practitioner for a failure to recognize the early symptoms and signs. The retort that many patients admitted to sanatoria as instances of incipient disease are not suffering from tuberculosis at all, and that prolonged treatment of a few patients is responsible for converting many early waiting cases into late ones, does not help us much. There are many other reasons. Apart from the difficult economic conditions of to-day, when vacant posts are only too quickly filled, and many patients, in consequence, put off seeking advice, hoping against hope that their suspicions may be unfounded, is it not possible that within recent years there may have been a certain change in the type of disease?

Following the post-War waves of influenza there can be no doubt that many patients present themselves, apparently soon after the onset of symptoms, with an extensive amount of trouble in the lungs. This is not the occasion to discuss how far these cases are in truth influenzal in origin, or cases of old tuberculous disease with a specific flare up consequent on superadded catarrhal infection. From a close inquiry into the history of many of those patients, I believe it is not unlikely, as is so often the case, that there is something to be said for both views. But the main basis for the complaint lies in our methods of dealing with the tuberculosis problem. Under the present order of things, the general practitioner of the future has little or no chance of seeing the disease in its early stages.

Greatly to the detriment of the patient and the medical student, the clinical study of tuberculosis has been removed, with a few notable exceptions, from the general hospitals to special clinics. In his watertight compartment, the tuberculosis officer has to carry on as best he can without the opportunity for interdepartmental consultation, or of utilizing any of the numerous methods of investigation with which a modern hospital is equipped. So long ago as 1910, Osler realized that a mistake was being perpetrated. To judge from recent letters in the public press, the laity are now showing anxiety on this point.

The onus of responsibility for the failure to detect early lung tuberculosis lies, not with the general practitioner, but with those in authority whose duty it is to make satisfactory provision for the teaching of medical students.

There is neither the time nor the necessity for me to analyse separately each symptom of early pulmonary tuberculosis and to attempt to assess its value. No symptom by itself is pathognomonic of tuberculosis of the lungs. Much stress has been laid, and rightly so, on the possible serious significance of a persistent "post-influenzal" cough, or to the story of a hæmoptysis in a young adult. But there are, I think, a few symptoms to which too little importance has been ascribed:—

Aphonia, for example, is too often dismissed as a hysterical manifestation, especially in young women. In my experience it is a not uncommon early symptom, arising presumably from an interference with the function of the recurrent laryngeal nerve in its intrathoracic course.

An increase in the rate of the heart, undetected by the patient—tachycardia, rather than palpitation—demands a careful record of the temperature for a week or ten days.

Pain in the shoulder in a patient complaining of being "run down" should not be too readily regarded as of extra-pulmonary origin. It may be referred from the diaphragm or it may be a manifestation of an apical pleurisy. In either case further examination of the lungs is indicated.

Notwithstanding statements to the contrary, anorexia is, in my opinion, a frequent

early symptom, generally in association with a slight degree of evening fever. On the other side of the picture, I am not convinced that a pre-menstrual rise of temperature is of such great diagnostic value as some authorities would have us believe, or that the absence of fever during menstruation rules out a state of activity of the tuberculous process.

In order to evaluate the symptoms accurately in a suspected case, it is important to listen carefully to the patient's story, to eschew the modern tendency to rush on to the latest method of examination, and to remember that the dread of consumption creates in many patients an overwhelming urge to minimize their symptoms.

On the other hand, we must always bear in mind that there are many conditions of the lungs which simulate tuberculosis and which begin with much the same respiratory symptoms. There are also systemic disorders in which the general symptoms of pulmonary tuberculosis are noteworthy features. Hyperthyroidism is, perhaps, the outstanding example. The ability to maintain a balanced judgment and a fine discrimination in these matters should be the aim of every practitioner of medicine, more particularly of the physician engaged solely in tuberculosis work.

Family history.—It is rather the fashion nowadays to discount the importance of a family history of tuberculosis. This may or may not be justified, but a history of close contact with an actively infectious member of the same household should be taken into serious consideration in weighing up the pros and cons in a doubtful case.

When we come to the physical examination of the patient, we have to realize once again that no one sign by itself justifies a positive diagnosis—apart, of course, from the discovery of the bacillus in the sputum. So many variations from the "normal" are compatible with health that considerable experience is required to distinguish what is definitely pathological.

It is customary for teachers to warn students of the differences found on auscultation and percussion, between the right apex and the left, but how many are there who impress upon them that the right side of the chest in a right-handed person normally expands more than the left? The slightest degree of spinal curvature and an occupational increase in muscle-volume will modify the percussion note considerably.

One of the most valuable signs on inspection is not so much a gross deficiency of expansion, as a lagging behind on inspiration of the upper or lower half of the thorax on one side. When this occurs it is usual to find a compensatory increase in the movement of the rest of the chest on that side.

Obvious wasting of the supraspinati may be regarded as due to underlying disease of some maturity, as also may shrinkage above and below the clavicle, and a dropping of the shoulder.

Palpation is of value when the tactile vocal fremitus is felt to be stronger on the left side than on the right. It is useful also for the detection of fluid, or a localized thickening of the pleura, to verify the suspected difference in expansion as noted on inspection, and to locate the apex beat of the heart. In women it is often difficult to perceive any tactile sensation.

Percussion.—Whatever may happen in the realms of cardiology it is unlikely that in diseases of the respiratory system we shall be able to dispense with the method originally introduced by Auenbrugger, at least for some time to come. Some examiners appear to get the best results through the auditory sense, others through the tactile. In any case, light percussion should be employed. According to some recent writers this would appear to be a fresh discovery. It was, of course, suggested to the profession over half a century ago by an eminent member of the Glasgow Medical School.

An important point to remember in connection with percussion is that the affected side, even in an early stage of the disease, may yield, not an impaired—but a slightly tympanitic—note. This phenomenon probably comes about from a slight degree of relaxation of the lung-tissue in the neighbourhood of the lesion, much as in more extensive involvement, particularly at the base, a Skodaic note is obtained in the upper zone. Sometimes, by reason of this qualitative alteration in the percussion note, the examiner may provisionally suspect the sound side.

A feeling of resistance on percussion, associated sometimes with tenderness, especially over the posterior apex, is a valuable sign of early infiltration. Such a finding gives the impression of the muscle being on guard much as occurs at the onset of an inflammatory lesion in the abdomen. This muscular spasm is said to remain as long as any active disease is present.

As to how far slight alterations in the limits of various bands of resonance in proximity to the apices can be accurately defined, or, having been delineated, how far they can be said to represent early disease, there is a considerable difference of opinion. Some examiners lay great stress on the value of this procedure; others less confident of their skill prefer to spend more time on other methods of examination. In any case percussion will not help us when the lesion is deep seated—nor, for that matter, will auscultation.

At the same time considerable assistance is still to be obtained from a correct use of the stethoscope. It is most important that patients should be told to take long deep breaths, in and out, through the mouth, and to give a good resonant cough at frequent intervals. But for the fact that such essential details appear frequently to be omitted at the time of examination, it would be presumptuous to make such elementary observations.

It is as well for the examiner to be on his guard against possible mistakes arising from the not uncommon extra-thoracic accompaniments, frequently subscapular in origin. Persistent dry adventitious sounds above the clavicle probably represent an old apical pleurisy as a rule. The earliest change in auscultation, in my opinion, is a weakening of the breath sounds. Later there comes the "blowing" element in expiration. Cogwheel or interrupted breathing should be noted but not over-emphasized, as it is common in rather nervous but apparently healthy persons. But a slight alteration in the character of the breath-sounds must not by itself be regarded as pathological. There must be at least one other abnormal finding before we think of a positive diagnosis. The most important is, of course, persistent crepitation, especially when present at one apex only. Actually the most likely sites at which to hear added sounds first are not at the extreme apices but below the clavicle in the second space anteriorly and behind, just internal to the spine of the scapula. I should have hesitated to mention this but for the fact that within the last decade, as a result of radiological examinations, this has been promulgated as a new idea. About fifty years ago two well-known Brompton Hospital physicians pointed this out, from clinical observations alone.

The signs of early tuberculous infiltration may sometimes be first detected in the axilla. Osler used to warn practitioners that an aneurysm might be missed if a patient's back were not carefully examined. In the same way, an early case of pulmonary tuberculosis may be overlooked if the axillæ are not investigated.

We can now proceed to examine the patient in the dark room. So much ink has been spilt over the comparative value of the ordinary clinical examination and the radiological examination that the welfare of our patients tends to become endangered. The use of the X-rays should be regarded as part and parcel of an ordinary routine examination when any doubt as to the diagnosis has arisen. It is essential that there should be the closest co-operation between the physician and the radiologist, both of whom should be present at the screening of patients and the reading of the films. If it is impossible for the physician to procure the co-operation

of a radiologist with extensive experience of chest practice, then he should take and interpret his own photographs.

The most exaggerated claims have been made on behalf of radiology in the diagnosis of early tuberculosis of the lungs, curiously enough, mainly by men not solely engaged in X-ray work. An independent record of the ultimate fate of the huge percentage of so-called "clinically silent cases" where the diagnosis has been established on X-ray examination, would be a valuable and interesting contribution to our knowledge. Perhaps more than in any other sphere of medical activity is a control series necessary. Many lusty undergraduates of considerable athletic prowess would, I fear, run the risk of prolonged sanatorium treatment on an X-ray picture of their chests.

It has been much the same with every comparatively new method of investigation. Radiologists in this country, on the whole, have stepped wisely and warily, and their services towards the elucidation of the difficulties in the diagnosis of early tuberculosis cannot be otherwise than gratefully acknowledged.

A certain amount of valuable information is to be obtained in screening alone, especially with regard to lighting up of the apices, and the movements of the diaphragm. But it is much safer to wait for the film before coming to positive conclusions. While it is true that the skiagram will generally show more extensive lesions than are revealed to the ear or finger, it is my considered opinion that except in the rarest instances dogmatic claims that radiological examination can diagnose the early case before a careful clinical examination made under good conditions, have not been, and cannot be substantiated. In order to cast a shadow an early focus has to reach a dimension of some size and, what is even more important, has to be of a certain consistency. The vascular and pulmonary changes which take place around an early lesion are not opaque to X-rays, but are discoverable by auscultatory and other means.

It must have been the disconcerting experience of many physicians to have seen from time to time patients with evidence of definite disease, to whom quite a short time previously an unhesitating opinion of "no tuberculosis" had been given, following a negative X-ray report.

Without a complete history of the case and especially in the absence of a knowledge of the symptomatology it is not possible to say definitely whether the densities seen on the film are of a tuberculous nature or not, much less whether they represent an active process or not, although it is possible to hazard an opinion on both these points. That small discrete densities at the apices and elsewhere can only be detected on X-ray examination is conceded. How far patients showing such densities are ill and in need of treatment is another matter. They are, as is well known, common enough at autopsy in persons dying from causes other than tuberculosis. Nevertheless, in the present state of our knowledge it cannot be too strongly emphasized that if we are content to come to a diagnosis in a doubtful case without invoking the aid of X-rays we are failing in our duty to our patient.

May I, in conclusion, be allowed to make a few remarks on certain laboratory methods of examination. The stress that has always been laid on not accepting a negative sputum as conclusive evidence of absence of early disease will receive fresh impetus from the recent pronouncement that under certain conditions the bacillus of Koch may lose its "acid fastness." When sputum is unobtainable and is thought to be swallowed, examination of a pharyngeal swab or the fæces, may yield positive results. The disadvantage of gastric lavage, which has been advocated, is the length of time that must elapse following animal inoculation before an opinion can be given.

In the blood picture there is nothing pathognomonic. Claims that alterations in the white cell count *after* injection of tuberculin are characteristic have been made by some investigators and denied by others. How helpful it would be if in the complement-fixation test we had anything approaching the reliability of the Wassermann reaction.

Experience, at the Oxford Eye Hospital, of the cutaneous, subcutaneous and blood-tests, showed that they differed so much as to be completely unreliable with the one exception of the focal reaction following subcutaneous injection of tuberculin. The danger of focal reactions in the lung following the use of tuberculin in diagnosis, has been much exaggerated. Those who strenuously oppose its use have no hesitation in employing the exercise test where the dose is quite uncontrolled, nor are they unduly alarmed at a severe reaction following the administration of sanocrysin or similar preparation of gold. Care, discrimination and experience are necessary in the use of tuberculin as in the other forms of investigation in any branch of medicine. Severe general reactions can be avoided by the use of a tuberculin obtained from a medium free from foreign proteins.

It is possible that severe reactions will be further eliminated as a result of the work which is being carried out in America and elsewhere on the chemistry of the tubercle bacillus. Not only may the protein of the bacillus itself be available for an intracutaneous test of pure specificity, but by the use of another fraction of the organism a precipitin method of diagnosis may become a practical proposition. In the meantime further indiscriminate and wholesale cutaneous and intracutaneous testing by old tuberculin is of little value except possibly to direct attention to a likely source of infection in a family.

In an endeavour to come to a conclusion for or against pulmonary tuberculosis in a suspected case, we have to start with an open mind, piece together the symptoms and signs, and employ all methods of investigation of proved value, traditional and modern.

Dr. Peter Kerley : The time is ripe for considering the value of radiography in the diagnosis of early pulmonary tuberculosis because from the radiographic point of view no spectacular advances are likely to be made in the near future. The technical problem, in competent hands, is solved, and the present problem of the radiologist is not the making of a final diagnosis but the accurate correlation of his findings with the clinical data.

The anatomical lesion produced in early pulmonary tuberculosis is dependent on many factors which are imperfectly understood. By careful correlation of clinical and X-ray findings we know that the anatomical lesion as seen radiographically varies enormously, not only in size and situation but also in density and number. That a combination of different anatomical lesions may occur in one individual is more than likely, and I put forward the following classification of the early radiological appearances of pulmonary tuberculosis—not as proven facts which can be applied to any case—but as a basis for interpretation which in conjunction with the clinical findings has been found to be reasonably accurate.

(1) The commonest early radiographic finding is the round focus first described by Assman. This focus is seen more often on the right side than on the left and has a predilection for the infraclavicular region (fig. 1). Occasionally it is seen in the lower part of an upper lobe or in the upper part of a lower lobe but this is unusual. The focus always has a circular appearance ; in about 50% of cases it is very sharply defined like a coin, while in the other 50% its margins, although tending to be circular, are ill-defined. The average size is that of a shilling, but occasionally it is as large as a florin or as small as a threepenny piece. It casts a homogeneous shadow, less dense than the shadow of the heart or aorta, but about equal in density to the shadow of the superior vena cava. There is no dense central nucleus; occasionally multiple foci are present but very rarely are these bilateral. When multiple foci are present the individual foci are seldom bigger than a sixpence. The symptoms associated with Assman's focus are usually malaise and cough. If the focus is sharply defined and has a homogeneous density, cough may be absent. Sputum, pain and pleurisy are not often associated with a well-defined Assman's focus. Hæmoptysis is also unusual unless the focus has a

translucent centre which indicates that it has broken down. My experience shows that where there is hæmoptysis in early cases of pulmonary tuberculosis, there is always a demonstrable cavity, although it may be necessary to take several films at different angles and of different degrees of density to demonstrate the cavity.

The general opinion at the moment is, that resolution with fibrosis is unusual once cavitation has begun in a focus of this nature. There are, however, cases on record where under suitable treatment a focus has disappeared without leaving any radiographic evidence of its existence. Healing by calcification is undoubtedly rare. This type of tuberculous focus is rare before puberty, but it has been seen at the age of 6½ years, and I have seen it in one patient aged 50. When the foci are very sharply defined and multiple they are impossible to diagnose from metastases, but their common localization in an upper lobe is against malignancy. A single sharply defined focus may be impossible to differentiate from a lung abscess. Hydatid cyst is mentioned as giving somewhat similar appearances but as a rule it is much denser than a tubercular focus.

(2) The second type of lesion seen in early pulmonary tuberculosis is a triangular opacity situated at the base of the right upper lobe. The apex of the triangle points to the hilum of the lung; the lower side is sharply defined by the interlobar fissure while the upper side is ill-defined. This lesion is always single and unilateral. Like the round focus its density is homogeneous unless necrosis and caseation are occurring in its centre. When it is seen as a true homogeneous shadow the symptoms associated with it are malaise and cough, while pain and pleurisy also occur early. This lesion is seen most often between the ages of 18 and 30. It has been described in children by Redeker, but there are few records of it occurring after the age of 35. Like the round focus, it does not tend to calcify readily, and if it does not break down, it heals and leaves behind a considerable fibrosis and thickening of the interlobar pleura. This particular type of tuberculosis has been described by American writers as benign and by French writers as dangerous and virulent. This discrepancy clearly shows how dangerous it is to generalize as to the outcome of any form of pulmonary tuberculosis on radiological evidence alone.

(3) The third type of anatomical lesion is seen as a collection of small spots usually deep in the centre of an upper lobe. These spots are about 2 or 3 millimetres in size and can only be differentiated from vascular shadows by the fact that they are situated in a ring-shaped manner in a small area. Fortunately this form of tuberculosis is uncommon but it is undoubtedly the form in which clinical proof of disease is present and X-ray evidence is apparently absent. The small spots are almost invisible, owing to local emphysema. I have seen a few cases of this nature in which the disease began with hæmoptysis and tubercle bacilli were found in the sputum. It was impossible by radiography alone to localize a pulmonary lesion definitely, but on following up the cases a cavity later appeared in the vicinity of a small group of spots which were hardly suspect on the earlier radiographs.

(4) True apical tuberculosis is now recognized to be an uncommon form. The X-ray appearances are typical, anything from four to ten spots, varying in size from that of a millet seed to that of a pea, being clearly visible above the clavicle (fig. 2). The symptoms associated with true apical tuberculosis are cough, malaise and occasionally pleurisy. As Fishberg and Haudek have demonstrated in a large series of cases, these apical lesions tend to heal very readily; caseation and cavitation seldom occur and consequently hæmoptysis is not to be expected.

(5) Occasionally in young adults between the ages of puberty and 18 years pulmonary tuberculosis begins acutely with abundant bacilli in the sputum and severe constitutional disturbance. The radiological appearance in cases of this sort is not a pneumonic consolidation as one would expect, but a single large cavity (fig. 3) with little or no focal reaction. True pneumonic phthisis, which is the "galloping consumption" of a previous generation, now appears to be rare.

In children the problem of correlating clinical data with X-ray appearances is more difficult, because pulmonary tuberculosis in children is invariably associated with glandular tuberculosis. An added difficulty is the fact that in children pulmonary tuberculosis is a benign disease, malaise being in many cases the only symptom for which the child is radiographed.

The classical round focus described by Ghon (fig. 4) is not often seen radiographically unless it has healed by calcification, when it shows up clearly. Ghon's focus is undoubtedly the usual form of pulmonary tuberculosis in children and the discrepancy between its frequency at autopsy and its absence on skiagrams during life has been explained by the fact that the focus usually tends to occur low down in the lower lobe so that on a skiagram it is hidden either behind the heart shadow or the diaphragmatic shadow. Recent work, however, tends to show that in the majority of cases Ghon's focus produces a lobar infiltration which completely obscures the focus and which is described as epituberculosis. There are one or two records of the round focus being visible through the epituberculous infiltration.

Redeker states that the epituberculous reaction produced by Ghon's focus gives entirely different radiological appearances from the epituberculous reaction provoked by bronchial gland tuberculosis. He has shown that when the primary lesion is in the lung, the whole of the lobe becomes opaque. As this condition improves, the opacity disappears in the centre and leaves behind two opaque triangles. The outer of these triangles has its base on the periphery and conceals Ghon's focus while the inner triangle has its base on the hilum and is probably the glandular reaction. Redeker gives the name "bipolarity" to this striking appearance. Rarely is a Ghon's focus seen without an epituberculous reaction. In so-called cases of occult tuberculosis in children there is probably a Ghon's focus without this reaction hidden behind the heart or the diaphragm.

The clinician is apt to minimize the value of radiographs in the diagnosis of glandular tuberculosis because in the past deficient technique led to radiological diagnoses of enlarged tuberculous glands when there was no clinical evidence to suggest their presence. This error was at one time so prevalent that chest radiologists wisely refrained from commenting at all on the root shadows. The last few years, however, have seen a substantial increase in the knowledge of the radiological appearances of this type of disease. We can now say with certainty that glandular tuberculosis causes two distinct X-ray appearances; the commonest of these is an ill-defined opacity radiating from the root of the lung and diminishing in opacity from within out. The glands themselves are not clearly visible on the affected side, but may be visible as a tumour shadow on the other side. The second and less common appearance is a tumour-like enlargement of the glands. This also is associated with an epituberculous reaction in the lungs but in neither form does the epituberculous infiltration involve the whole of the lobe (figs. 5 and 6). A third radiological appearance has been described under the name hilitis. In this condition there is induration of the glands without much enlargement and with infiltration of the hilar connective tissue. Dense white lines are seen radiating from the lung root, which is somewhat wider than the average. The increased density of the lung root may of course be partly due to chronic hyperæmia. I have no doubt myself but that this condition is more often non-tuberculous than tuberculous and frequently follows bronchial complications of the acute infectious fevers. Proof of the nature of this type of condition can be obtained in the following way: if a von Pirquet test is made and there is a constitutional reaction, serial radiographs show that a typical epituberculous infiltration develops around the thickened hilum when the lesion is tuberculous. This epituberculous infiltration disappears very rapidly in the course of a week or ten days.

There is no need for me to stress at this meeting how essential collaboration between clinician and radiologist must be if we are to progress further. Obviously

PROC. ROY. SOC. MED.
Vol. XXVII, No. 2.
Section of Medicine.

PLATE I.

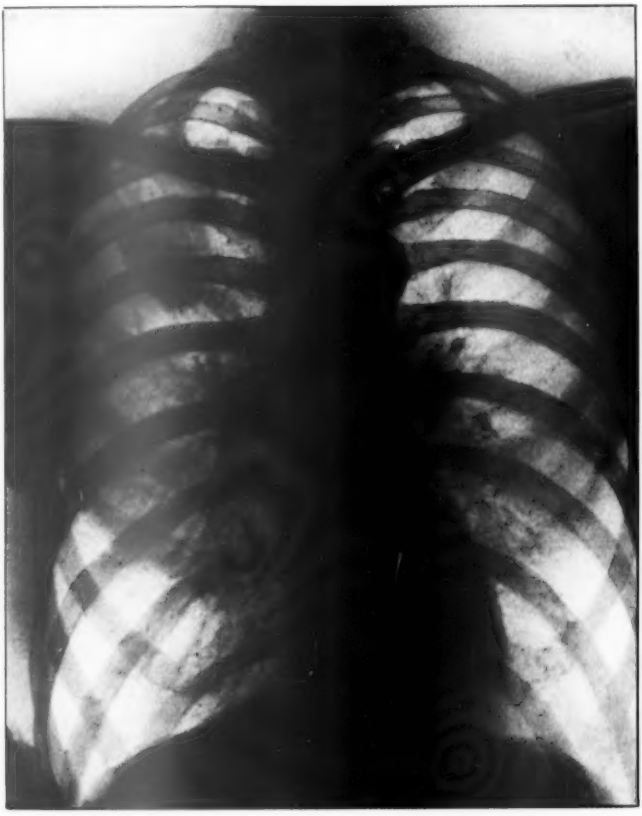


FIG. 1.—Early tuberculous focus in the right infraclavicular region (Assman's focus).

PROC. ROY. SOC. MED.
Vol. XXVII, No. 2.
Section of Medicine.

PLATE II.

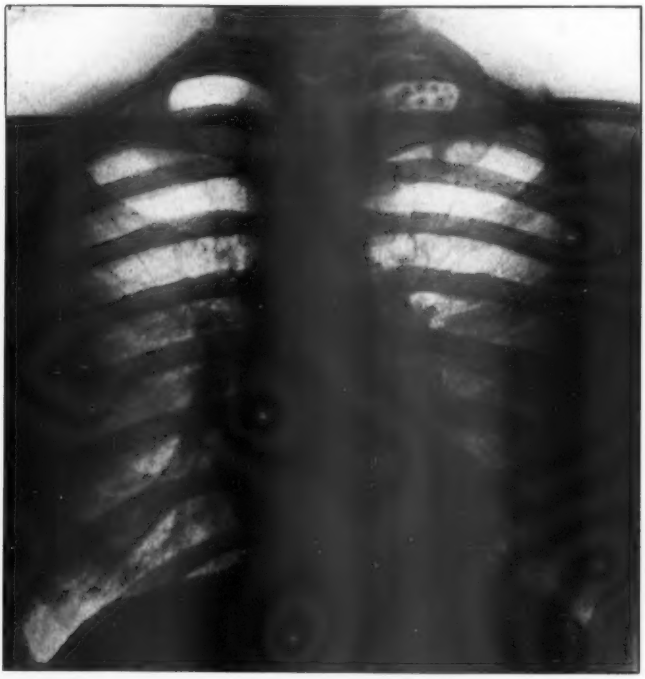


FIG. 2.—Left apical tuberculosis.

PROC. ROY. SOC. MED.
Vol. XXVII, No. 2.
Section of Medicine.

PLATE III.

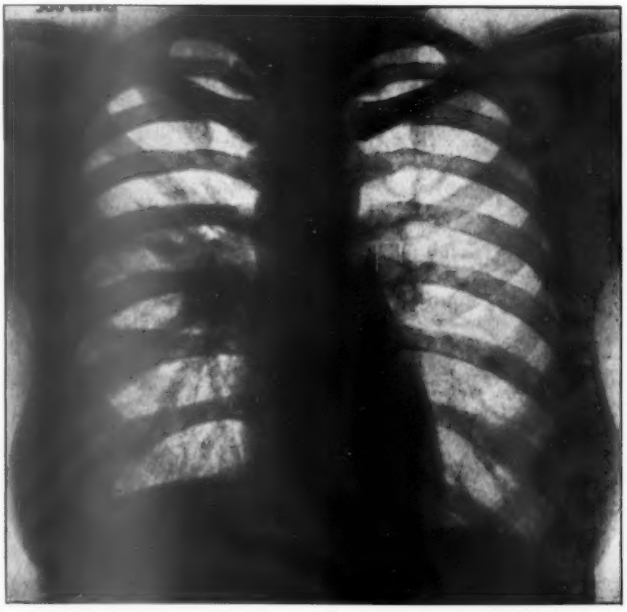


FIG. 3.—Acute onset of tuberculosis in a young adult. Note large cavity with fluid level and enlarged bronchial glands.

PLATE IV.

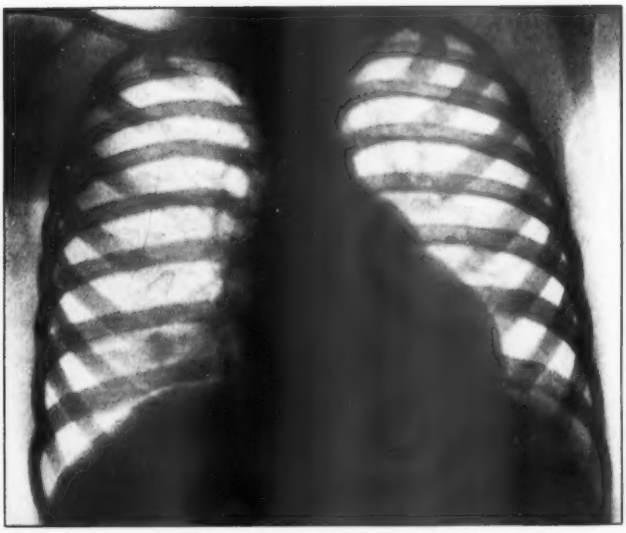


FIG. 4.—Ghon's focus in the right lower lobe. The pneumonic reaction around it is almost completely resolved.

PLATE V.

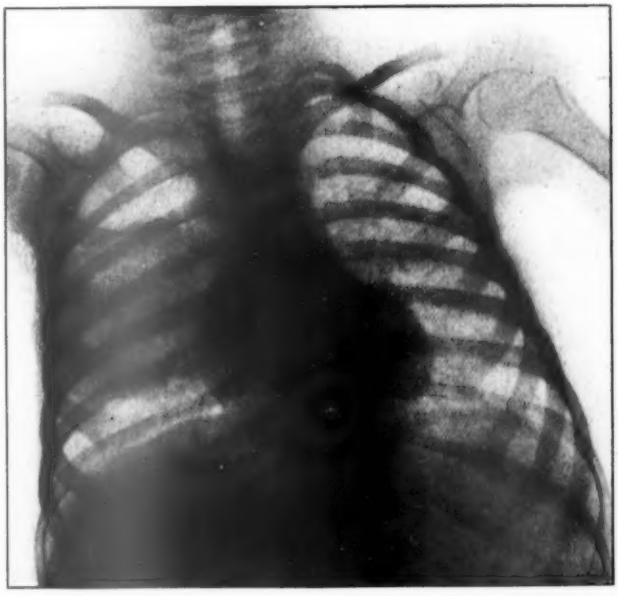


FIG. 5.—Glandular tuberculosis in a child. Note the sharp epituberculous reaction in the right lung.

PROC. ROY. SOC. MED.
Vol. XXVII, No. 2.
Section of Medicine.

PLATE VI.

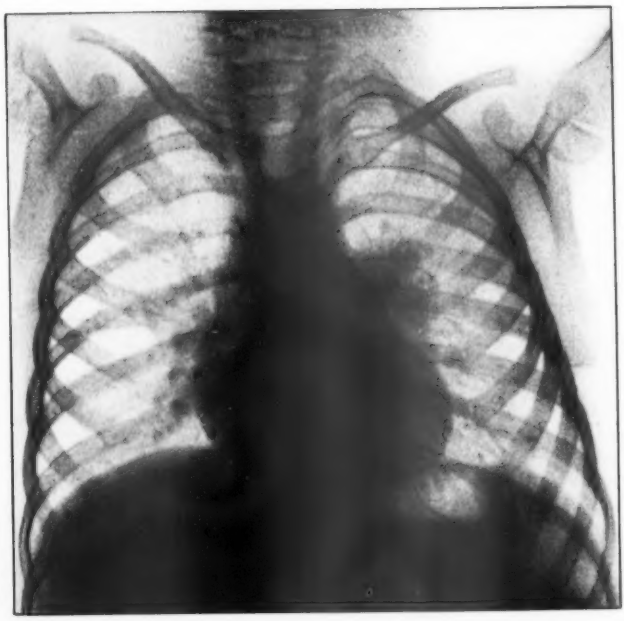


FIG. 6.—Same case as fig. 5, two months later. The lung reaction has cleared up. Note the dense bronchial glands on the right side and the enlargement of the para-aortic group in the left side.

no individual can hope to see all the variations of early tuberculosis. Probably many more will come to light when the State appreciates the full value of thoracic radiography. If every patient attending a tuberculosis dispensary were radiographed and all contacts with proven cases screened, the expense would be more than offset by the reduction in the national incidence of the disease.

Dr. J. A. Struthers: Of problems peculiar to the dispensary I would mention that of mental attitude as the most important. In the practice of any speciality there is a tendency to mental bias, and this is particularly strong when the speciality is one disease; and in this case it is accentuated by the very name of the dispensary and the doctor's official title. In fact medical students—and even fellow doctors—appear to find it hard to believe that any other type of case is ever encountered, or that I have any interests except those which centre round the activities of Koch's bacillus. This tendency must be counteracted by keeping in touch with general medicine and so retaining a sense of proportion and a realization that tuberculosis is only one disease among many—that it may, for instance, be simulated in its early stages by hyperthyroidism or carcinoma of the alimentary tract—and that hæmoptysis and pleural effusion may have other causes. It is safe to say that tuberculosis is never forgotten as a possible cause of disease; and I would therefore suggest that a valuable working rule in a doubtful case is to think of every other possibility first. We hear much of the case of tuberculosis which has been missed, but in this instance the danger is the opposite one of diagnosing that disease where it does not exist. And it is just in dealing with the fine points which have been mentioned by other speakers that mental bias counts for much—or may be the all-important deciding factor. The opener of this discussion referred to the bad results ensuing from the dissociation of tuberculous work from that of a general hospital as a cause of cases being missed. I would also refer to the bad results that may ensue from such dissociation, but in the opposite direction.

I would add to what has been said about tuberculosis arising in those who are thought to be otherwise healthy, a reference to cases in which it comes on in those who are known already to have other diseases—in particular in elderly persons suffering from chronic bronchitis and emphysema. It is, of course, a moot point whether the condition is not tuberculous from the beginning, but there are cases in which the sputum is negative for years and then is, one day, found to be positive. Similarly, pulmonary tuberculosis has at times to be thought of as a complication of diabetes, gastric ulcer, and even of valvular disease of the heart. Contrary to what is sometimes stated in textbooks, it is not unknown as a complication of mitral stenosis. I myself have known three cases in two years of the last-mentioned combination.

As regards the type of case seen at a dispensary as compared with, say, a general medical out-patient department, I think, from what I have seen in nearly nine years of both, that there is a tendency for patients to come to the dispensary in a somewhat earlier stage. This is of course no doubt due—at least in part—to the fact that a follow-up system is maintained in connection with the dispensary and so patients keep in touch with it and tend to influence other possible sufferers to seek early advice. This, of course, is the primary essential for the early diagnosis of tuberculosis as of any other disease. No amount of study of the refinements of auscultation will avail if potential patients do not present themselves, and the dispensary system does much to ensure that this primary essential is fulfilled.

A method of approach to the early case which is found in dispensary work, and which is not often found elsewhere, is by the examination of contacts. This work is done systematically, and I find, from figures of a series of over 500 contacts of cases of tuberculosis, that just under 4% were suffering from that disease. These cases would, no doubt, have been detected later, but valuable time was thus saved. This

4% is made up of those who have signs of active tuberculous disease. There are others who show signs of healed lesions, or in whom the only point of note is a positive tuberculin reaction. It is not justifiable in our present state of knowledge, to regard these persons as suffering from disease, but only to regard them as having evidence of infection. On this point there is some diversity of opinion. I have recently read a lament that we have no biochemical test which would detect tuberculosis before the stage of symptoms. Now if we take "symptoms" to mean the subjective sensations of the patient, it is obvious that the patient will not consult his doctor at this stage and therefore the biochemical test will not be given a chance. This difficulty does not arise in the case of examination of contacts, among whom there would be good scope for finding the value of such a test if and when it is evolved.

Among these contacts I have noticed two points of interest which bear on the present subject of discussion. The first is that I have come to be suspicious of any contacts who, on the first examination, are found, without any obvious cause, to be febrile; as I have found on several occasions that these patients showed unmistakable signs of disease in a very short time. The other point that these cases have impressed is that the onset of chronic pulmonary tuberculosis may be relatively sudden. This, of course, is being increasingly recognized in all types of patients, but it is liable to be particularly impressed on one in these cases, where the recognition of the earliest signs of disease is felt to be not so much a triumph of diagnostic skill, as evidence of the frustration of months or years of effort to prevent the onset of trouble.

Those who are inclined to be critical may perhaps say that if a contact has been under observation for months or years such a catastrophe should be averted. I can only reply that these contacts often go for that length of time and continue with their work without showing any evidence of the presence of disease, and that, short of treating them all as being in the so-called pre-tuberculous stage, or notifying them, and the rest of the population, as actual cases—but without symptoms or demonstrable signs—I see no method of dealing with them except that which is now adopted. We all devoutly wish for a diagnostic test such as the one mentioned but, although hardly a year passes without the evolution of some new test, unfortunately they do not prove of value in practice.

With regard to the method of dealing with the doubtful case when observation in bed is needed, it is essential that such patients should, if possible, be kept away from cases of proved disease. I say this, not with any desire to open up the thorny question of the possibility of infection and re-infection, but because there is considerable risk of causing the patient undue alarm. The everyday happenings in an ordinary medical ward are often terrifying enough to those who are not used to them; but I have known cases where association of early cases with more advanced cases has had adverse effects on the former which lasted for years.

Dr. R. R. Trail: The wording of the title of this discussion (The Early Diagnosis of Pulmonary Tuberculosis) deserves special attention; it is not the "Diagnosis of Early Pulmonary Tuberculosis," and this is no quibble. The more one sees of phthisis the more is one struck with the truth that its history is the history of symptoms. This is why so many physicians are wearied with the tale of "early pulmonary tuberculosis." Many cases of moderately advanced disease have a history of weeks only; occasionally the same is true of the advanced case. When the full extent of the disease is discovered it is far too easy to succumb to the temptation to find the scapegoat and he is just as often as not the patient himself. One often hears the patient's story that he saw his doctor three years ago because of a cough; the doctor's reply is that he never saw the patient during these three years.

From the histories of about 3,000 sanatorium cases which I have had under treatment at Midhurst, I have picked out, very summarily, those points that

would appear to be most often missed though pointing steadily to the need of investigation, and from them have tried to work out some headings on history, investigation and physical signs that might be of some assistance in early diagnosis to the general practitioner.

Every doctor knows that a cough that lasts for more than a month, in spite of the ordinary measures employed for some such common cause as bronchitis, is definitely "suspect," but not every doctor seems to advise his patient to return at the end of that month for further investigation. The same is true of the symptom of indigestion, and it would appear that a large number of patients have been treated for this symptom for years and have been in an advanced state of pulmonary infiltration before the first examination of the chest has been made. Veins in the throat are still blamed for hæmoptysis, although it is a certain sign of chest disease, in the absence of a heart lesion. With this symptom I would bracket that of pleurisy, with or without effusion. The cause is tuberculosis in so large a proportion of cases, that no blame for immediate diagnosis will fall on the practitioner who makes it. About 30% of sanatorium patients have a history of pleurisy or hæmoptysis some three years before admission. There is no doubt that the wisest plan is to advise the patient with either of those conditions to have a short educational stay in a sanatorium. The after-history of such cases as have been admitted is interesting; it forms a distinct contrast, in that none of them, in a period up to nine years from the date of discharge, have developed signs of a diagnosable lung lesion. Fistula-in-ano and a history of amenorrhœa do not seem to be sufficiently correlated with chest disease. The presence of a fistula is strong presumptive evidence of chronic phthisis in a patient with good resistance. Amenorrhœa is a far commoner symptom of early disease than is generally realized. The history of patients with such conditions may be a sad one, as the true cause has too often been demonstrated by the lighting-up of the quiescent lung lesion through operation under chloroform and ether. It may not be amiss to sound a note of warning on the danger of such anæsthesia. Gas-and-oxygen for major operations on patients suffering from advanced tuberculosis has, in my experience, had no ill-effects, but, unfortunately, re-activation and definite spread of disease has too often followed the employment of chloroform and ether.

When any of these hints in the history of the patient has been discovered, it does not need an expert to carry out simple investigations which may help to clinch the diagnosis of active disease. Rest is the great criterion. By it alone the doctor will be able to differentiate between the active and quiescent case, between the case that requires further investigation and possible treatment, and the case of old disease with the common sequel of secondary bronchitis which will often clear up with a few days in bed. If the patient is put to bed for three days with hourly temperature readings, he may be found to have a persistent fatigue, or a temperature which is subnormal on waking but shows a gradual rise between 2.0 and 7.0 p.m. Should the temperature be normal, the next step is to set a test on exercise. This is easily carried out and easily interpreted. A brisk walk for twenty minutes will produce a rise of temperature in a normal person, but the fall will be slow in a case of active tuberculosis. If possible, rectal temperatures should be used. Should the temperature be above 99° F. and the pulse above 90 within half an hour after return from exercise, the doctor will have another definite hint towards his diagnosis.

It is now time to call in the assistance of a radiologist with experience in chest cases. Only such a radiologist ought to give his observations in a suspected case, and in such a case he will be of far more use to the doctor by his interpretation of screening than he can by film examination. Should he see a loss of translucency at one apex that does not light up on deep inspiration or after cough, or irregular movements of the diaphragm and mediastinum, it is time to add up the observations on history and temperature reactions and to clinch the diagnosis. In doubtful cases

considerable experience in chest disease is necessary to give positive diagnosis from films; even the expert may require two films at three months' interval. It is not unusual for normal patients to be labelled tuberculous; the lung reticulations producing fan-like radiations from the roots in city-dwellers are too often read as hilum tuberculosis, and bronchi and blood-vessels seen in section read as cavitation and nodules of old disease. Chronic bronchitis has been erroneously labelled peribronchial tuberculosis, whereas there is no such disease. Hilum glands are not tuberculous unless they have drained lung infiltration, and while they can certainly break down and burst into surrounding lung tissue, they are only secondary to peripheral disease of some standing.

Sputum and night sweats are not early signs, and when tubercle bacilli are found the case is already showing late manifestation of lung infiltration.

The same can be said of physical signs. In early diagnosis they are of much less importance than history and careful investigation on exercise and rest. Moreover, the most competent physical examiner will fail to find by stethoscope the full extent of the disease. Most tuberculosis workers will agree that X-ray examination and post-mortem evidence bear out the statement that added sounds above the clavicle mean infiltration of the upper third of the lung, while signs below the clavicle mean involvement of at least the upper half. It follows that the failure to make out such adventitious sounds as are present is not such a grave matter as the patient or his doctor would readily believe. Their discovery and interpretation is not easy and the specialist has acquired the necessary ability only by long practice. On the other hand, there is no doubt that they would be heard much more frequently if they were searched for in the early morning rather than in the evening surgery hours, by which time the patient with early signs of activity will have coughed up or absorbed most, if not all, of his mucoid sputum. A much more easy sign will be present in most cases—lack of movement from restricted respiration. Eyes and hands are of much more value than ears in early diagnosis.

No reference is made in this paper to laboratory tests, but an attempt has been made to confine remarks only to such indications as the general practitioner may understand without specialized knowledge, to pick out for him suspicious points in a history, to outline an easily applied investigation on rest and exercise, and to state the stage at which he might seek expert guidance on X-ray findings and physical signs.

Dr. W. E. Lloyd said he wished to lay stress on the importance of hæmoptysis in the early diagnosis of pulmonary tuberculosis. In a number of cases, hæmoptysis, often small in amount, was the first indication of ill-health and might occur without any previous history of cough. In these early cases physical signs were often absent, but a skiagram might show a small localized lesion usually situated in the subclavicular region. The opacity in the skiagram was rounded in shape and its diameter varied between 1 and 2 cm.

[A series of slides was shown demonstrating these early lesions of tuberculosis, and in most of the cases the diagnosis had been confirmed by finding tubercle bacilli in the sputum. In conclusion, Dr. Lloyd emphasized the great value of radiology in the diagnosis of pulmonary tuberculosis in its earliest stage.]

Section of the History of Medicine

President—Sir StClair Thomson, M.D.

[*November* 1, 1933]

The Doctor, the Quack, and the Appetite of the Public for Magic in Medicine

By Professor H. Burger (Amsterdam)

It is a curious and at the same time highly disappointing fact, that a decrease in appreciation of the medical profession must be recorded in a time of unprecedented efflorescence of medical science. The progress of medicine in the last century is greater than that in all the preceding centuries put together. Since intuition, dogma and contemplation have made place for investigation and experiment, results have been obtained which our predecessors could not foresee in their wildest dreams. Dogmatic deduction has had to make way for the inductive method, under the guidance of which medical art has, in the latter half of the last century, developed into an experimental science.

The scientific results obtained have been widely applied to the benefit of suffering humanity. I will only mention, in passing, the statistics of disease and death-rates and will restrict myself to the one thing for which we can never be too grateful—the decrease of bodily suffering. This decrease is not, in the first place, due to the invention of a great number of anodynes, but much more to improved diagnosis and more efficient treatment, and chiefly to modern surgery, which by painless operation insures health and energy to numbers of people who formerly had to drag a sickly body to the grave. We may well ask with astonishment, what can be the reason that, with the growth of medical science there has not been a parallel rise of public appreciation of our profession; why, to-day, the multitude crowds round the loquacious quack, and why even educated people listen to the plausible words of the hypnotist. It is remarkable that intelligent people will expect healing of their ailments from the quack, of whom they know only that he knows nothing whatever of the structure and functions of the human body, while the same people would not think of entrusting a broken clock to any but a skilled and trained watchmaker.

This must surely be a sign that, deep in the soul of the people, lies the belief that medical art is a divine gift which may be exercised without science or study. Such conviction is not at all incomprehensible. We little Asklepiads are not Æsculapius himself. An effectual preventive of death is not yet ours. Nature, the great healer, makes no distinction betwixt quacks and experts, but the quack never omits to claim the credit when his merciful ally effects a cure. Moreover, the higher medical science has risen, the more it has, in its pride, estranged the public from the doctor. When medical art moves from the sick-bed to the laboratory, when we treat diseases rather than diseased people, there slips from our grasp a powerful instrument,

the personal influence of one man on another, which the quack knows how to handle in a masterly way.

Whoever sees in the problem of quackery nothing but deception on the one hand and stupidity on the other, fails to grasp the essence of the matter. He fails to appreciate both the personal element and the influence of the soul on the body in the processes of disease and healing. When, after weeks in a dim sick-room, a patient is removed to the country, an immediate, marked improvement, the visible turn for the better, is not only to be ascribed to the action of the different air on the lungs and the blood, but in even greater part on the mind. Some physicians are to their patients, by their whole personality, like a healing sun. Such are physicians by the grace of God. Even their presence at a sick-bed promises recovery, and indeed brings it in many cases, not by their learning alone, but also by the confidence in recovery which they manage to inspire in their patients. Toothache vanishes on the door-step of the dentist. Coué, whom no one considered an impostor, effected his cures, not by his theory but by his personality, by his humanity, by the joyous hope which he implanted in his patients. The optimism of the doctor is transmuted in the heart of the patient into a steadfast faith, which in many a sick-room is a powerful factor for good. Thus the quack has really a much firmer position than the honest doctor. He can play the optimist under all circumstances. He can prophesy a cure of even the most grievous diseases. Doubt never assails him. He can promise anything. His conscience does not burden him. If in the promised time the cure be not established, then it is an exceptionally stubborn case, and a second and a third treatment is clearly needed. When in the end the failure can no longer be glozed over, then the fault lies with the bungling of his predecessors—the doctors—and the cheated sufferer is reproached with having waited too long to come for treatment.

Meanwhile many a quack can register real cures; not by his remedies but by his personality, his manner, his advertising. That cramps, paralyses, functional disturbances of practically all the organs may vanish under strong suggestion has long been known. Even real organic maladies sometimes present, under appropriate stimulation, a turn for good that is not to be underrated. Such cures occur in the practice of every doctor, but make by no means the impression on the public that they do when coming from a quack. The doctor who cures or shall we say assists Nature in the cure, has but done his duty. Curing is his profession. *Not* being able to cure would be a sign of his incompetence! How different is public appreciation of the quack. Failures, mistakes, absurdities are not laid to his account. After all he is only a quack! But a recovery during his treatment, even though in reality he has had no part nor lot therein, will go from tongue to tongue and become more and more significant and marvellous at each recounting.

Mankind believes in the wonder of healing as a divine gift. Only so can it be explained that a loutish country-bumpkin for years managed to attract a stream of people, who were or who imagined themselves sick, to Staphorst, a small village in the east of my country. Among them were men and women of culture and rank, who never thought of this yokel as dowered with medical knowledge, but whose hope was fixed on the miracle of his innate or magically acquired gift of healing. For years they came in crowds though the cures can have been mere oases in a vast desert of failures. Those who returned unrelieved felt no urge to boast of their adventure. It was far other with the cured. A Baroness from The Hague was at last rid of the nervous spasms she had had for years! A minister lost his characteristic little cough and was suddenly able to hold forth without his sugar-and-water! Such as these gave to many a sufferer an inducement to visit the miracle-worker.

The history of quackery yields splendid samples of mass-suggestion by the craziest "cure-twaddlers." Some forty years ago I was a witness in Amsterdam of

the fact that Sequah, an American rheumatism-healer, by sounding a trumpet, collected thousands round him and then broke the crutches of cripples, and, to the boundless astonishment of the crowd, made these hobblers walk away unsupported for the first time in years. Sequah drove about in a four-in-hand attended by liveried servants and he visited the royal residence which seemed to have become infatuated with him. But things went badly with all the poor creatures cured in public. The Dutch Society for the Suppression of Quackery on inquiry found that the trial they had been through had cost them dear.

In many ways more remarkable, and more instructive from the point of view of mob-psychology, is the recent Zeileis story, of which much was made some years ago. In the castle at Gallspach, an Alpine village in Austrian Bohemia, lived for several years a wizard with a long beard, the quondam locksmith, Valentin Zeileis. From far and wide the sick and crippled flocked to this magic castle, where all the ailments that plague humanity were banished by a dazzling electric spectacle. The whole village was adjusted to his activities. All its houses were crammed with the sick. At all hours in his waiting-room, or "Præparatorium," was a crowd in an agony of excitement. The examination of a new patient was a very simple affair. The wizard just made some passes over him with his magic wand and at once recognized the nature of the disease from the power of the flashes that came from that marvellous staff! The conjurer then directed the treatment to begin. A horde of a hundred to a hundred and fifty patients, stripped to the waist, poured into the treatment hall—the "Mysterium." At the entrance grinned a human skeleton; the hall was illumined by little red lamps; the walls were decked with stuffed snakes; the air was laden to choking-point with ozone. At the head of the sad procession went the blind, hand-in-hand, led by a "sister"; the rest followed. The end of the procession consisted of the crippled and the lame on crutches and stretchers. This mob was literally driven past the electric apparatus, and for a minute or two was treated with Roentgen rays, with high-frequency rays "intensified by radium" and with "helium lamps" and other things. Untranslated I will read you what one of Zeileis' own disciples related of this "Mysterium": "Es zischt und sprüht, braust Funkengarben aus dem Geisterbesen, wirft weisse Lichtsignale über die nackten und halbnackten Körper, knattert, leuchtet, glüht grün, lila, rosa, ein spukhaftes Inferno."

An Inferno indeed, entirely fitted up with a view to the money-box of the long-bearded Lucifer, who drew from this hell an income of five or six thousand marks a day (more than £100,000 a year). Between a thousand and two thousand patients per day were treated in this manner. Whoso considers this will agree with the great Erasmus of Rotterdam, when the latter makes his Moria maintain that human life is but a game of folly. It is indeed no wonder that, in Germany, where quackery was not held in check by the law, "Zeileis-Institutes" sprang up like mushrooms. For here, too, on account of the mystical tendency of the post-war mentality, the ground was favourable for the reception of such electrical hocus-pocus. Three years ago it fortunately occurred to Zeileis to bring a law-suit for slander and dishonest competition against the famous professor Lazarus, who in word and writing had pilloried the "Gallspacher Heilslehren." This gave the universally respected professor, who was impelled by his love of truth, the opportunity to shed some much-needed daylight on all the Zeileis nonsense. The sources of the electric rays were the same as had long been used by all radiologists, but with professional skill. The novel element was supposed to be in their combination, namely, the "hundred-fold reinforcement" of the high-frequency by the addition of radium. Physically, however, such a combination is an absurdity. The same applies to the helium lamp. The minute doses of ultra-violet and Roentgen rays administered by Zeileis could not possibly do anything, neither could the moment's radiation with arc-light. At the request of Lazarus, a number of healthy people allowed themselves to be examined

by Zeileis with the wand. On that occasion they suddenly developed heart trouble, bilious inflammation, gastric ulcers, pulmonary consumption. Lazarus himself, as sound as a bell, was given to understand at two "Original Zeileis Institutes," at Münich, on the same day, at one, that he was suffering from pulmonary catarrh and from inflammation of the bile duct; at the other, that he had spinal disease. But however the diagnosis ran, the treatment was always the same. In the lawsuit, "Zeileis versus Lazarus," by way of providing comic relief, two cases were mentioned of ventral swelling in women, swellings which, in spite of diligent radiation, grew larger and larger, until at last they emerged and had to be notified at the office of the registrar of births! Lazarus tells of his meeting with a paralysed woman in Gallspach, who had attended there regularly for eight years, and in that period had undergone a thousand radiation treatments! But now, she thought, she would soon be cured! Should one wish to dismiss the examples of Gallspach as not applying to us Westerners; should we think that in these regions people are not so easily taken in by such grotesque humbug, then I need only remind you with regard to my own country, of the Sequah fever, which raged for a short time it is true, but most violently, and which, in the manner of an epidemic of influenza, within a few weeks had attacked the whole country.

Our generation is perhaps more learned, but not more sensible than those of yore. Superstition is not openly confessed, but it is deeply ingrained. The oracle of Delphi was reincarnated in Staphorst. Hundreds still seek healing from the old lady in Whitechapel who performs miracles with an egg. Women of standing and culture who suffer from rheumatism believe in the healing properties of an East-Indian amulet-bracelet. One may then well ask: "Is not the struggle against quackery a hopeless task? Do not even the gods fight stupidity in vain?" Little help may be expected from the instruction as to the structure, functions and disturbances of the human frame. Pope's epigram about the danger of "a little learning" is ever applicable. Students at their first clinical lecture feel, in their own bodies, the most horrible diseases. Even more quickly in the unenlightened does a little knowledge of anatomy and pathology produce shadows of the imagination which make men and women an easy prey to quackery.

Yet it will not do to get out of the problem of quackery with a casual "populus vult decipi." The appetite of the public for magic in medicine has not only a comical and a philosophical side but also a very dark social aspect. The damage it does to individuals and to the community is immense; it cannot be expressed in figures. What cheated hope, what bitter disillusionment, how much anxiety artificially roused and sustained! Lazarus relates of unfortunate beings deliberately kept in fear of cancer for years, who, under the care of a sensible physician, would never have lost their balance. Which of us older practitioners has not many a time had the satisfaction of putting the unsteady on the right track? The medical man, with all his faults and imperfections, is distinguished from the quack by his honest desire for the good of his patients, which is a thing that leaves the quack cold. I need only remind you of the mysterious books on sexual matters, meant to get money out of the pockets of schoolboys, and by which in many a child's heart the most terrible anxiety, nay, even despair, has been awakened. The casual lightness with which the despair of the sick is exploited is truly criminal. Zeileis could cure diabetes without prescribing a diet; cancer without an operation. By such promises thousands were robbed of a fair chance of recovery. By inquiry from hospitals and from physicians Lazarus collected hundreds of case-reports which he laid before the court. Here is a random selection: goitre behind the breast-bone, which might certainly have been cured by operating; the patient died of suffocation on the way home. Pleural effusion which might have been saved by timely tapping. Patients with "Zeileised" gastric ulcers, which afterwards perforated, admitted to the hospital, in a pitiful condition.

I have resurrected enough of such stories. But yet such stories as that of Zeileis are the best means of opening the eyes of the authorities and the public to the dangers of quackery. I do not know how matters stand in this country, but in mine the judges show unlimited long-suffering towards quacks. Evidently they believe more than they themselves realize, in a gift of healing unknown to science, but bestowed on simple souls. The Gallspacher "Mysterium" sheds a peculiar light on the unsuspecting nature of this belief. We matter-of-fact people, who watched that scene from a distance, wondered how it was possible that, of the hordes driven through that electric hell, so few, on returning to clear daylight, became shamefully aware of their folly. The musical-comedy background, the absurdity of the magic wand, the absence of any medical examination, the uniform treatment of every thinkable ailment, this we thought was too much to be unresistingly digested by sane minds. It has often struck me that our judges attach great value to the statements of witnesses who declared that they had been benefited by a quack. What do they think of the many statements which Zeileis would be only too glad to show them about spinal consumption, cancer, tuberculosis, nephritis, heart diseases, cured in his Inferno?

Neither is the amount of money the public pays for its gullibility to be accurately estimated. Yet the publicity—the thousands of bills, pamphlets, advertisements—give some idea of the sums sacrificed year after year on the altar of deception. If only for this last most tangible reason, an energetic fight against quackery is imperative.

And now for a word as to the relation of doctor and quack to the public. In the great company of medical men and women there are good and bad elements, and there are quacks there too. I am willing also to assume that not all quacks are wholly to be condemned. Undoubtedly there are among them those who honestly believe that, by the favour of God, they possess the true remedy. This belief is similar to the exaggerated confidence in the power of a certain mode of treatment which is sometimes found in medical practitioners. Such people may be driven by their love of their neighbour or by public spirit. But in the great army of quacks the virtuous ones are a small minority. I have for years occupied myself with a particular group of quacks—those who exploit the deaf. They are numerous, and none is tormented by an interest in the fate of their patients. It is most aggravating that, year after year, these unfortunate people pay a high tax into the pockets of a gang of cheats. It is especially aggravating that the poor contribute what they cannot afford, and with no more chance of the realization of their hopes than has the drowning man who clutches at a straw.

I have an idea that in the medical corps the truly bad are very exceptional. Bernard Shaw, in his "Preface on Doctors," maintains in his usual hyperbolic manner, that "it is simply unscientific to allege or believe that doctors do not perform unnecessary operations and manufacture and prolong lucrative illnesses." Undoubtedly there are doctors whose principal thought is not the patient, but the patient's purse. But the same spirit is found among those who follow other vocations, and it is unfair to judge the whole profession by this standard. I cannot believe that there are many among us who would unnecessarily put their knives into a fellow creature. I do not deny that the choice of the medical career is often determined by its social prospects. Yet among those who have entered upon medical practice there will be comparatively few who do not feel the heavy personal responsibility for the lives entrusted to their care.

A similar relation exists between doctors and quacks, with regard to medical insight. I am far from denying diagnostic intuition, an inborn fitness for medical work. Nurses not infrequently have the clinical eye and I do not mind confessing that on the first suggestion of scarlatina, erysipelas and pneumonia, things which do not belong to an otological clinic, I involuntarily glance up to read the confirmation

of my suspicion on the face of my head nurse. This innate bump of diagnosis partly explains the success of some quacks, who, however, on account of their ignorance of the human body, and also for the ethical reasons just mentioned, are most dangerous persons. Although I consider the suppression of quackery an urgent necessity, I do not for a moment entertain the possibility of eradicating the Erasmian folly. I am fully aware of its immortality. The struggle is not against that, but against those who exploit the foibles of the soul of the people for their own profit. It is the struggle against deception in its most contemptible form, the deception which speculates on the afflictions of mankind.

Section of Epidemiology and State Medicine

President—J. D. ROLLESTON, M.D.

[*November* 24, 1933]

The Smallpox Pandemic of 1870-1874

PRESIDENT'S ADDRESS

By J. D. ROLLESTON, M.D.

ABSTRACT.—The Vaccination Act of 1853 inspired by the Epidemiological Society of London was the cause of the incidence and fatality of the pandemic being less in the United Kingdom than in foreign countries.

Origin of pandemic in France before outbreak of Franco-Prussian War. Its spread through the country. Vaccination state of civilian population and army in France in 1870.

Incidence, fatality and characteristics of the pandemic in England and Wales, London, Scotland and Ireland and foreign countries with special reference to Germany and German army. Lack of hospital accommodation for smallpox cases in London. M.A.B. hospitals opened. Absence of ambulance service. Aerial convection of smallpox. Smallpox fatality in the various Metropolitan boroughs.

Incidence and fatality of smallpox heavy in civilian population in Germany as compared with the well-vaccinated army, but lower in Southern German States, where primary vaccination was compulsory, than in Prussia and Saxony which had no vaccination laws.

Further statistics illustrating difference in smallpox fatality in different countries and groups of individuals according to their vaccination state.

THE present year is the eightieth anniversary of the passing of the first compulsory vaccination Act for England and Wales, in the preparation of which our parent society played a very important part. In introducing the Vaccination Extension Bill into the House of Lords on April 12, 1853, Lord Lyttleton stated that:—

"For almost all the information he had to lay before their Lordships, having no scientific knowledge of the subject himself, he was indebted to some able and learned persons belonging to the Epidemiological Society—a new society among whom the leading members were Sir Benjamin Brodie, Dr. Bright, and Dr. Southwood Smith" (Hansard, 1853, cxxv, 1002).

Lord Lyttleton's information had been derived from a report drawn up by a committee of the Epidemiological Society of London and entitled "Report on the State of Smallpox in England and Wales and other Countries and on Compulsory Vaccination." The report contained a summary of vaccination laws and the mortality of smallpox in various countries, proofs of the neglect of vaccination in England and Wales, and demonstration of the consequences of this neglect. In conclusion the suggestion was made that vaccination should be made compulsory in some form or other within three or four months of birth, and that the registration of births should be the foundation of the machinery for every vaccination. In the committee which drew up the report the best known men were J. F. Marson, physician to the London Smallpox Hospital, and author of several valuable articles on smallpox, and Edward C. Seaton, the honorary secretary, who became president of the Society in 1869, and in 1875, as first assistant medical officer of the Local Government Board, published an important paper entitled "The Recent Epidemic of Smallpox in the United Kingdom, in its Relation to Vaccination and the Vaccination Laws," to which

I shall frequently refer. The report was first presented to the President and Council of the Epidemiological Society on March 26, 1853, was immediately forwarded to the Home Secretary and was ordered to be printed by the House of Commons on May 3 and by the House of Lords on June 27 (Seaton, 1868). Lord Lyttleton's Bill passed through both Houses of Parliament without any opposition, and ten years later compulsory vaccination laws were passed for Scotland and Ireland also. The vaccination law of 1853 enacted that vaccination should be performed at an earlier age, namely, within three or four months of birth, than that required in any foreign country. Although the United Kingdom suffered severely in the pandemic with which I shall deal to-night, the incidence and fatality would have been considerably higher had it not been for this law, the provisions and working of which, as Seaton points out, conferred on the United Kingdom a position entirely different from that which it had held at the time the Society's report was presented. Seaton remarks that though the Act of 1853 was to a considerable extent an experimental Act, and was very imperfect in its provisions, there was abundant evidence of its having been largely effective. The smallpox deaths under 5 years of age which had hitherto formed 75% of the smallpox deaths at all ages fell in a few years to 55, while the proportion of deaths at this age in Scotland and Ireland still remained at 75% until compulsory vaccination was introduced by law in 1863. Moreover, during the year following the enactment of the 1853 law the number of infantile vaccinations more than doubled, and more than 300,000 vaccinations over the age of 1 year were also carried out (Seaton, 1868).

The Act of 1853 was followed by the Act of 1867 which empowered Boards of Guardians to appoint vaccination officers, this appointment being made compulsory by another Act in 1871.

Many years ago in an article on "The Epidemiology of Smallpox," published in a special vaccination number of the *British Medical Journal* during the last great London epidemic, the first president of this Section remarked that a complete account of the pandemic of 1870-72 was still a desideratum. In the present address, though it makes no claim to satisfy Sir Arthur Newsholme's demands, I have tried to survey the principal events connected with the most formidable outbreak of smallpox which had occurred since the introduction of vaccination. While a brief account will be given of the pandemic in various countries on the Continent, most of my time will be devoted to a description of its behaviour in this country and particularly in London.

My choice of the subject was determined not only by the interest which a former President of the Section of the History of Medicine takes in the past, but also by the fact that in 1901 and 1902 I had the good fortune, as one of the late Dr. Wanklyn's assistants, to see a good deal of the most severe epidemic of smallpox that had visited London since 1871. Faithful to the traditions of the Epidemiological Society (worthily maintained by this Section) of which, in the words of its most illustrious opponent, vaccination was "its first love and the solace of its later years," I have undertaken the study of an epidemic of smallpox which more forcibly than any other inculcates the value of vaccination and revaccination. Speaking as one who is a clinician rather than an epidemiologist, I feel convinced that had Creighton, to whose scholarship we are so much indebted, had any clinical experience of a severe smallpox epidemic he would not have maintained his hostile attitude to vaccination, particularly in his treatment of the pandemic of the early seventies.

It is important to realize at the outset that though the spread of the disease throughout Europe was facilitated by the events connected with the Franco-Prussian War of 1870-71, smallpox was already present in several European countries, particularly France, Holland and Belgium before the outbreak of hostilities (Gins).

France.—The pandemic appears to have originated during the last quarter of 1869 in France where it broke out in the North-West (Brittany), the North-East

(Aisne and Pas de Calais) and the South-East (Gers, Ariège and Pyrenées Orientales). During the year no less than 4,164 deaths in France were due to smallpox. The disease continued to spread during the winter of 1869-70, so that by the end of 1870 the whole country was affected. During the first few months of 1870 some of the large towns were attacked, especially Orleans, Bordeaux, Lyons and Bourg (Colin). In Bordeaux which in 1870 had 195,000 inhabitants, 9 to 10 persons died daily of smallpox in June and July, 1870 (Kübler). Before the declaration of war on July 15, 1870, the departments chiefly affected were Morbihan, Ille et Vilaine, Vaucluse, Ardèche, Nièvre, and Haute Saône. In Paris the epidemic first attacked the civilian population, as the Army before the outbreak of war consisted of soldiers who were on the whole protected by vaccination and revaccination (Laveran). The epidemic, however, lasted longer in the Army than in the civilian population (Colin).

During the period 1860-69 the monthly smallpox deaths in Paris until December 1869 were always below 100, except in October 1861 when they numbered 113, and during the winter of 1865-66, when they ranged between 111 and 148. In 1869, the deaths which had been 39 in October rose in November to 93, and in December to 113, while in 1870 the smallpox mortality in Paris was ten times as high as it had been in previous years. So alarming indeed had the increased prevalence of smallpox become that on May 25, 1870, or nearly two months before the declaration of war, a conference was held in Paris to decide the best means of controlling the spread of the disease (*Gaz. d. hôp.*, 1870, xliii, 245).

It is well at this stage to consider the vaccination state first of the civilian population in France, and then of the Army. According to Prinzing, during the period 1860-69, only 59% of the infants born in France were vaccinated and at the outbreak of war about one-third of the French population were unvaccinated and in many departments such as Aveyron and Corsica as much as four-fifths. The natural result therefore was that the smallpox mortality among the infantile population during the epidemic was very high. In Paris, out of a total of 10,331 deaths from smallpox during the years 1870-71, 213 were in the first month of life, 151 in the first to second month, 107 in the second to third, 290 between three and six months, 397 between six and twelve months, or a total of 1,158 deaths in children under one year (Vacher). The total number of deaths from smallpox in France during the epidemic is estimated by Borne at 60,000 but Vacher regards even 89,954 deaths as an under-estimate.

French Army.—For some years prior to the outbreak of the Franco-Prussian war there had been a gradual increase in the incidence of smallpox in the French Army, in which vaccination and revaccination were being carried out in a very slovenly fashion. Although the French War Office in 1859 had ordered the vaccination of all recruits on entering the Service, this order was by no means strictly enforced, as during the years 1866-69 only 37 to 49% of the primary vaccinations and 32 to 35% of revaccinations were successful. It is not surprising therefore to find that in 1868 the number of smallpox cases in the Army was three times that of the preceding years, viz., 6·5 per thousand in 1868 as compared with 2·2 in 1866 and 2·3 in 1867 (Colin).

After the outbreak of war the recruits, owing to lack of time, were not vaccinated at all, and as the result of the severe initial losses formed nearly two-thirds of the Army in the later months of the campaign. A vast amount of susceptible material was thus provided, and resistance to infection was considerably lowered by the stress and privations of active service and the general misery associated with an unsuccessful campaign. According to Perilman in a recent Paris thesis, the total number of smallpox cases among the 600,000 French soldiers mobilized in 1870-71 was 125,000, of whom 23,470 died—a fatality rate of 18·7%. Although the Paris Army suffered most severely from the disease, the provincial armies were also considerably affected, particularly the troops organized to relieve Paris. According to

Prinzing, Orleans, Chartres and Le Mans were the main centres, in the north the principle foci were Amiens, Bois Guillaume and Rouen, and in the south the fortresses of Belfort and Langres, and the towns of Dijon, Besançon and Pontarlier. In no place, however, did the disease last longer than in Paris or require such extensive hospital accommodation as was provided at Bicêtre in the outskirts of the metropolis, where in the course of four months almost as many cases were admitted as to the London Smallpox Hospital in twenty years, i.e., about 7,000 (Colin).

Moreover, the unusual severity of the disease was shown by the fatality rate in 1870-71 at Bicêtre being 14·6% as compared with a death-rate of 5 to 6% in the Army in non-epidemic years and one of 5·43% in the German Army during the pandemic. Hæmorrhagic forms of smallpox were particularly frequent and were attributed by Briquet to poor nourishment and life in the trenches during the winter. Although hæmorrhagic smallpox was frequent at Bicêtre as elsewhere during the pandemic, we have the authority of Colin for stating that the hæmorrhagic phase was not a sudden development. Black smallpox had been relatively frequent in the winter of 1869-70, both in the provinces and in Paris. It was not, however, until the end of November that hæmorrhagic smallpox became exceptionally frequent, 130 cases being admitted to the Bicêtre hospital in the month of December 1870 alone.

In spite of the severity of the disease in the Army, the fatality rate was considerably lower than in the civilian population. At Bicêtre for example it was 14·6% as compared with 19% in the civilian population before, and 35% during, the siege of Paris. This lower fatality appears to have been due to the fact that revaccination though by no means generalized was at all events commoner in the Army than in any other class of the community, and secondly to the fact that at least nine-tenths of the soldiers were under 30 years of age and therefore more likely to be still protected to some extent by their primary vaccination than the elderly patients admitted to civilian hospitals. In spite of the severe losses sustained by France as the result of the neglect of vaccination, it was not until the year 1902 that vaccination was made compulsory in the first year of life and revaccination in the eleventh and twenty-first years. In the case of war, public calamity or a threatening epidemic vaccination or revaccination was made compulsory at any age for those who could not show that they had been successfully vaccinated or revaccinated during the last five years. The result of this law, which was strictly enforced, was, as Teissier has shown, that during the five years of the Great War the French Army, exclusive of the Colonial troops, among whom there were 44 cases, had only 26 cases of smallpox. Teissier states that if smallpox had occurred on the same scale in 1914-18 as in 1870-71 there would have been nearly 1,200,000 cases with more than 200,000 deaths in the French Army alone.

England and Wales.—Until towards the end of 1870 the pandemic had been mainly confined to France. In England it did not assume considerable proportions until the last quarter of 1870, when there was a considerable incursion of refugees from France, but there had been a gradual increase in the incidence of the disease for some time previously. Munk and Marson, the two principal contemporary authorities on smallpox who were on the staff of the Highgate Smallpox Hospital, considered that the epidemic began in November 1869. They give figures showing that the number of admissions to their hospital rose from August 1869, when the disease was sporadic only, the numbers for the following quarters up to October 1870 being as follows: 93, 182, 222, 337 and 341. According to Farr (*Thirty-fourth Ann. Rep. Reg. Gen.*, p. 221), the weekly deaths from smallpox in London had been only two in the fifteenth week of 1870, between the twenty-seventh and thirty-ninth week they ranged from 9 to 15, in the next five weeks from 13 to 27, then suddenly rose to 40 in the forty-fifth week, and in the last week of the year to 110.

In England the epidemic was at first almost confined to London and Liverpool which together contributed 879 to the 1,229 deaths in England for the last quarter of 1870 (Seaton). The mining districts of North England and certain parts of South Wales were the next to become attacked, and the smaller outbreaks in the country were traceable to these four centres of infection. In 1871 the epidemic spread rapidly and by the second quarter of the year nearly every one of the eleven registration divisions of the United Kingdom had been affected. The climax of the epidemic in this country was reached in the first quarter of 1872, when 7,720 fatal cases were registered in England and Wales (*Thirty-sixth Ann. Rep. Reg. Gen.*, 1875, p. 46). Subsequently there was a steady and rapid decline, the numbers of deaths from the disease registered in the last quarter of 1873 being only 277, which, according to the Registrar General's report for that year, was probably the smallest number that had occurred in any quarter since the beginning of the century. In England as in all the other countries attacked, the epidemic was characterized by the remarkable frequency of malignant and hæmorrhagic cases, although according to MacCombie the frequency of hæmorrhagic smallpox was greater in the epidemic of 1876.

Although this epidemic of smallpox was one of the severest on record in this country, the annual average death-rate in prevaccination times was more than three times the death-rate of the epidemic of the seventies. Seaton illustrates this statement by the fact that the estimated annual smallpox death-rate in England in the eighteenth century was 3,000 per million of the population, while the mean annual death-rate of the 1871-72 epidemic was 928 per million, being 1,024 in 1871 and 833 per million in 1872. A comparison of the mortality of the 1870-73 epidemic with the previous great epidemic of the century in 1837-40 shows that the proportionate mortality of the later epidemic was less than two-thirds of the mortality of the 1837-40 epidemic.

On the other hand the severity of the 1871-72 epidemic can be estimated by the fact noted by Farr that whereas the mean annual mortality per 10,000 in England and Wales during the twenty years 1850-69 was at the rate of 2·04, in 1871 it was 10·24 and in 1872 8·33 (*Thirty-fifth Ann. Rep. Reg. Gen.*). I would also emphasize the fact mentioned by Seaton that in none of the European countries during the pandemic was the rate of mortality from smallpox so low as in the United Kingdom. The death-rate in Prussia during 1871 was considerably more than twice as great, while the death-rate in Holland was three times as great as that in England.

As might be expected, the smallpox mortality varied considerably in the different registration districts of England and Wales. In spite of the proximity to London, where the mortality was the highest but one, the South Eastern district with a mortality of 0·46 per thousand of population and the South Midland with a mortality of 0·51 per thousand, suffered least, whereas the Northern division which comprised the counties of Durham, Northumberland, Cumberland and Westmorland suffered most, as shown by a mortality of 2·36 per thousand. Next came the Metropolis (1·48) and the Welsh division (1·13). In the Welsh division the excess of mortality was due to the mining districts of Monmouthshire and South Wales, the mortality in North Wales being much below the average. In the West Midland division which comprised the counties of Gloucestershire, Herefordshire, Staffordshire, Worcestershire and Warwickshire, the mining county of Staffordshire contributed in 1871 considerably more than half and in 1872 nearly two-thirds of the deaths from smallpox (Seaton). The smallpox mortality of the epidemic in the chief towns of England during 1871-72 is given by Seaton as follows. Sunderland headed the list with a mortality of 8·6 per 1,000 of population in 1871 and 0·54 in 1872, then came Norwich (3·04 per 1,000 in 1871 and 3·9 in 1872), Wolverhampton (4·14 in 1871, 2·6 in 1872), Newcastle-on-Tyne (5·4 in 1871, 1·03 in 1872) followed at some interval by Portsmouth (0·34 in 1871, 4·39 in 1872), Sheffield (1·68 in 1871, 2·42 in

1872), and Nottingham (1·65 in 1871, 2·32 in 1872). The lowest annual average was in Leicester, where it was 1·6 per thousand for the two years. The total number of smallpox deaths in England and Wales during the quinquennium 1870-74 was 69,018, the rate per 100,000 living being 11·3 in 1870, 101·2 in 1871, 83·1 in 1872, 9·8 in 1873, and 8·8 in 1874 (*Min. Health Rep. Public Health and Med. Subjects*, 1921, No. 8). The mortality in the London area will be discussed later.

In addition to the lower fatality which I have mentioned and the change in age-incidence with which I shall deal later the epidemic of the early seventies in England showed three striking differences from the great epidemic of 1837-40 which Creighton sets forth as follows: "It was a more sudden explosion destroying about the same number in two years (in a population increased between a third and a half) that the epidemic a generation earlier did in four years. It was an epidemic of the towns and the industrial counties, more than of the villages and the agricultural counties; it was an epidemic of London more than of the provinces.

London.—The first fever hospital in London was opened in Gray's Inn Lane in 1802 under the name of the "House of Recovery," after the example of several provincial towns, but London did not possess any public hospital for infectious diseases at the onset of the 1870 epidemic. It is true that a smallpox hospital had been established at King's Cross in 1746 and was replaced in 1815 by the London Fever Hospital which had been moved from its original site in Gray's Inn Lane, the smallpox hospital being removed to Highgate where it remained until 1896, when it was finally shifted to Clare Hall, Barnet. In 1848 when the ground was required by the Great Northern Railway the London Fever Hospital was removed to Islington (Parsons). Both the London Smallpox Hospital and the London Fever Hospital, however, though charitable institutions, required payment from patients, though the expenses of a certain number were defrayed by the guardians. Fever cases including smallpox were also admitted into general hospitals and workhouse infirmaries. At the time of the epidemic in 1870 there were therefore no public fever hospitals in use, though under the Metropolitan Poor Act of 1867 an order had been made to provide for the reception of fever cases, including smallpox, and three hospitals at Hampstead, Homerton and Stockwell respectively were nearing completion. At the commencement of the epidemic the principal accommodation for smallpox was at the Highgate Hospital which contained only about 100 beds. This supply was exhausted in October 1870, and new patients had at first to remain in their own homes or were admitted to infirmaries. On December 1, 1870, the Hampstead Hospital subsequently known as the North Western Fever Hospital, which had been first used by the Metropolitan Asylums Board in the previous January for relapsing fever, was re-opened with a further supply of 150 beds. On January 5, 1871, accommodation on the same site for another seventy patients was provided by the erection of an iron shed from the grounds of the London Fever Hospital, and additional accommodation was subsequently made in the form of wooden huts and marquees. Permanent hospitals were also opened at Stockwell in January and at Homerton in February 1871. An old battleship named "The Dreadnought," moored in the Thames off Greenwich was made to serve as a convalescent hospital for male patients and from March 13 to October 14, 1871, the old workhouse at St. Mary's, Islington, was similarly used for over 300 female convalescents. The accommodation on "The Dreadnought" was at first for 200 patients and was subsequently increased to 250 and later to 300 beds (*Med. Times and Gaz.*, 1871, i, 634). In May 1871, land was purchased by the M.A.B. for the erection of another hospital at West Brompton, but this hospital which acquired considerable notoriety in the 'eighties as the Fulham Smallpox Hospital and was subsequently named the Western Hospital, was not opened until March 1877. At an early stage of the epidemic a number of cases were admitted to the voluntary hospitals. The *British Medical Journal* of January 21, 1871, p. 73, states that twenty cases had been under treat-

ment at St. George's, and in the issue of February 4 we read of twenty at the London Hospital, twelve at St. Bartholomew's, eight at Westminster, four at Guy's, three at King's College, two at St. Mary's and one each at Middlesex, St. Thomas's and University College Hospitals. The rapidity with which the cases multiplied and their high fatality are shown by the fact that within two months of opening of the Hampstead Hospital 572 cases were admitted and 97 died—a mortality of 16·67 per cent. (*M.A.B. Minutes*, 1870-71, iv, 355). Similarly the accommodation at the Stockwell Hospital, subsequently known as the South Western Hospital, which opened on January 31, 1871, with 102 beds had rapidly to be increased to 600, which was partly effected by the erection of marquees in the grounds, as had been done at the Hampstead Hospital (*First Ann. Rep. Committee of Management of the Stockwell Fever and Smallpox Hospital*, 1871-72).

In his interesting history of the Metropolitan Asylums Board, Sir Allan Powell has calculated that the cases of smallpox admitted to the Board's hospitals, though amounting to 16,000 during the epidemic, were only one-third of the number for which accommodation was required. Apart from the comparatively small number admitted to the voluntary hospitals and workhouse infirmaries the remainder were treated in their homes by Poor Law District Medical Officers (often in a single room occupied by a whole family), or in the case of better-class patients by private medical practitioners.

According to Farr (*Thirty-fourth Ann. Rep. Reg. Gen.*, 1873, 220-1) the deaths of the unvaccinated in the London hospitals were 45%, which was double the mortality in private practice. Moreover, in vaccinated persons suffering from smallpox the mortality in hospitals was 10% as compared with 3% in cases treated in their own homes.

The transport of patients, many of whom were gravely ill, from their homes to hospital left much to be desired. It was not indeed until at least ten years later that the land ambulance service of the M.A.B. was even partially organized. The following vivid description of the state of affairs existing at the time of the 1870-72 epidemic is taken from a paper by two prominent members of the Board, Surgeon General Bostock and Sir Vincent K. Barrington:—

"The duty of the removal of patients rested on the several boards of guardians, and the methods adopted by these bodies differed in important details. The vehicles were in some instances the property of the guardians, in others of the vestry or district board, and in others again were hired for the occasion. They were defective in construction and unsuitable for the safe transport of persons prostrate with disease. In many instances the carriages after use were housed in a manner most objectionable and dangerous to the public health, as for example when a carriage, after being used for removal of a smallpox case was placed in a job master's yard surrounded by other carriages. Frequent complaints were made of the carriages carrying patients to hospital stopping at public houses, into which the drivers and patients' friends went for refreshment. Moreover, difficulty was frequently experienced in obtaining a carriage when required and the delay thus caused increased the danger of the spread of the disease. Nurses to accompany the sick were seldom provided; in most cases the patients travelled alone, and occasionally reached the hospital in a dying condition. Sometimes they were accompanied by friends, not always sober, who returned home in public conveyances."

The danger of a smallpox hospital to the inhabitants in the neighbourhood, which formed the subject of Power's classical report to the Local Government Board in connection with the Fulham Smallpox Hospital in the next decade, was emphasized by several persons in the 1871-73 epidemic in London, and by none more forcibly than the writer of an editorial in the *Lancet*, 1871 (i), 629, as follows:—

"It is almost impossible to resist the complaints of persons who are residing in close proximity to the mass of contagious material which is now being accumulated in the smallpox hospital. Complaints are made at Hampstead where it is stated that several fatal cases have occurred in close proximity to the hospital. Similar complaints have been made at Stockwell, where 630 patients are now located in a space of ground originally intended for the accommo-

dation of less than half that number. In Liverpool the residents near the workhouse hospital at Toxteth have brought forward very substantial evidence of the disease having extended from the temporary smallpox wards to the neighbouring houses. We have repeatedly condemned the aggregation of such large numbers of smallpox patients under one roof, and we venture once more to state that no hospital for the treatment of acute cases of smallpox should be permitted to take in more than 100 cases and that no convalescent hospital should treat more than 300."

On the other hand, Dr. Stevenson, the Medical Officer of Health for St. Pancras, stated that he was unable to trace any connection between the existence of smallpox in Kentish Town and the Hampstead Hospital or the Fleet sewer leading therefrom. The district, he said, was thoroughly infected with the disease long before the hospital was opened for smallpox cases, and as the number of patients in the hospital increased, smallpox diminished in Kentish Town, subsequently increasing as the number of patients in hospital decreased (*M.A.B. Minutes*, 1872-73, vi, 262, 267). Dr. A. Collie, the Medical Superintendent of the Homerton Hospital, also pointed out that during the period, February-July, 1871, no cases of smallpox occurred in the City of London Infirmary, which stood at a distance of about 90 ft. from the westmost pavilion of the hospital, although at that period cases of smallpox had been admitted to that hospital. Moreover, from October 1, 1871, to the end of 1874, 3,178 cases of smallpox were treated in the smallpox division of the Homerton Hospital simultaneously with 2,611 cases of fever and other diseases in the fever department of the same hospital, without any case of smallpox arising in the fever department. Similarly, Dr. Chalmers states that careful inquiry made by Gairdner and Russell in 1872 as to any relationship between the Parliamentary Road Smallpox Hospital at Glasgow and an agglomeration of cases in the neighbourhood resulted in a verdict of non-proven. In spite of the medical evidence, however, a suit was brought by Sir Rowland Hill, whose house adjoined the North Western Hospital, against the Metropolitan Asylums Board in 1879, and after eleven days' trial the jury decided that the hospital was a nuisance, that the defendants during the epidemic of 1871-72 did not use proper reasonable care with reference to the plaintiff's rights or with respect to the ambulances (*Brit. Med. Journ.*, 1879 (ii), 895). An appeal by the Board was unsuccessful, and for over three years (May 1879, to November 1882) the hospital remained closed, an agreement being finally reached by the purchase in 1883 of Sir Rowland Hill's property.

As regards the mortality in the Metropolitan unions it was highest in the East End (Bethnal Green having 5,462 deaths per million population, Shoreditch 4,860, Hackney 4,290, Poplar 3,645, and Whitechapel 3,369) and lowest in the south-west and south-east (Lewisham 737, Westminster 1,329, Woolwich 1,499, Greenwich 1,630, and St. Giles 1,979). Seaton draws attention to the fact that Bethnal Green which was notorious for its neglect of infantile vaccination, was the only Metropolitan union in which the proportion of deaths under 5 years of age remained at the average of the period preceding the Act of 1867 which had reinforced the Act of 1853. In all the other unions there was a striking reduction in the proportion of smallpox mortality among young children as compared with that before 1867. The total number of deaths from smallpox in London during the quinquennium, 1870-74, was 10,841, the rate per 100,000 living being 30 in 1870, 242 in 1871, 54 in 1872, 3 in 1873 and 2 in 1874 (*Min. Health Rep. Public Health and Med. Subj.*, 1921, No. 8).

According to Fox, the highest number of weekly deaths from smallpox in London viz., 288, was reached at the beginning of May 1871, when the epidemic had lasted just six months. At the end of June the number suddenly declined until in October and November it had come down to 60. The second maximum occurred in December when the weekly number of deaths was 106. The fatality as well as the incidence of the disease then gradually declined, until in August, 1872, the average amount of smallpox deaths was reached and the epidemic terminated after a duration of

ninety-three weeks. The case fatality was unusually high. According to Letheby it was 19% of the cases admitted to the Upper Holloway Hospital, 18·2% of the Stockwell admissions and 19·8% of the Homerton cases, the average for the whole of the cases treated in the M.A.B. Hospitals being 19·1%. On the other hand, in ordinary times the death-rate at the London Smallpox Hospital ranged only from 12·9% (1864) to 17% (1863), the average rate for many years being 14·3%.

As regards the difference of mortality in the two sexes, the returns of the M.A.B. hospitals for 1870-72 show that the percentage of deaths in males (19·50) was higher than that in females (17·64), this difference being attributed to extra wear and tear undergone by men, their more irregular habits and the fact that their occupations brought them more in contact with the disease. The difference in the incidence and fatality of the disease in the two sexes was much more pronounced in adults than in children. Up to 20 years of age the number of cases for the period 1870-72 was 4,112 in males and 3,803 in females, while the death-rate was nearly the same, viz., 17·9% for males and 17·6% for females. In a paper read before the Epidemiological Society on the various factors influencing the mortality in smallpox and based on the study of 6,221 patients admitted during this epidemic to the Hampstead Hospital, of which he was medical superintendent, Grieve stated that sedentary employments, such as those of clerks, tailors and salesmen, contrary to what might have been expected compared favourably with the others. The highest mortality he found occurred in occupations in which dissipated habits prevailed, such as those of cabmen or barmen, or in which the patients had been exposed to a continuous high temperature such as those of blacksmiths, cooks and laundresses. Grieve specially emphasized the prejudicial effect of chronic alcoholism and regarded the likelihood of recovery in an imperfectly vaccinated hard drinker as small. The comparative fatality among the vaccinated and unvaccinated in this country and abroad will be considered later.

Scotland.—Both Scotland and Ireland suffered later and less severely from the epidemic than England and Wales, the maximum mortality in the first two countries not being reached till 1872, whereas in England the peak was in 1871. The mortality from smallpox in Scotland which the epidemic reached in 1871 was highest in Edinburgh, Leith, Glasgow and Dundee. The total number of deaths in the country during the period 1871-74 amounted to 6,262, the mortality in the years 1871, 1872, 1873 and 1874 being 42, 71, 33 and 37 per 100,000 respectively (*Ann. Rep. Reg. Gen. in Scotland*).

As regards Glasgow, which was much less affected than Edinburgh, Chalmers has pointed out that whereas in the period 1855-57 when vaccination was optional, 89% of the deaths from smallpox occurred among children under 10, in the period 1870-72, or six years after the introduction of compulsory vaccination into Scotland, when 85% of the children born were being vaccinated, the proportion of deaths under 10 fell to 38%, and under five years from 85 to 26%. On the other hand, among the older children the majority of whom had been born before the compulsory vaccination Act had become operative, the proportion of deaths rose from 4 to 12%.

Dundee was remarkable in having the highest proportionate infantile mortality from smallpox, viz., 28% under 5 years of age, but, as Seaton points out, this was little more than a third that which occurred in Berlin and not very much more than a seventh of that in Leipzig. Generally speaking it was the more thorough vaccination in early infancy which was the cause of the comparatively low smallpox mortality in Scotland during the pandemic.

Ireland.—In Ireland the epidemic first appeared towards the third quarter of 1871 and lasted till the second quarter of 1873 (Seaton). The total number of smallpox deaths in the country during the two and a half years was 4,292, of which 665 occurred in 1871, 3,248 in 1872, and 379 in 1873. The heaviest mortality was in Dublin and Cork. The deaths in Dublin were 1,557 or at a rate of 5 per thousand

of population, which exceeded that of any large English town, except Sunderland, Norwich, Wolverhampton and Newcastle-on-Tyne. The deaths in Cork amounted to 1,873, a rate of 9·6 per thousand of population, which was higher than that of any large town in England (Seaton). According to T. W. Grimshaw, senior physician to the Cork Street Fever Hospital, Dublin, the fatality at the three Irish hospitals, Cork Street, and Hardwicke (Dublin) and the Cork Hospital was higher than in the London hospitals, being 21·6, 20 and 22·5% respectively.

Germany.—According to Prinzing, in the summer of 1870 Germany was almost free from smallpox, and at the time of the outbreak of war Chemnitz in Saxony was the only place where there was a severe epidemic of the disease. Elsewhere there were only isolated cases in the various Federal States in June and July 1870. With the entrance of French prisoners into German territory a sudden change took place. Among the first towns to suffer were Königsberg, Graudenz, Thorn, Danzig, Stettin, Stralsund, Schneidemühl, Swinemünde, Frankfurt-on-the-Oder, Magdeburg, Muhlhausen and Münster, which had all been free from smallpox for months, or had only had sporadic cases (Kübler). Infection took place owing to the active interest in the new arrivals shown by the civilian population who thronged the railway stations and prison camps, conversed with the prisoners with whom they exchanged clothes and entered into various commercial and friendly relations. The reason for the rapid spread of the disease was that unlike the Army the civilian population were very inadequately protected by vaccination either because no vaccination laws existed, as in Prussia and Saxony, or as in Bavaria, Hesse, Baden and Wurtemburg only primary vaccination was required by law, revaccination not being made compulsory in any State until the Imperial Vaccination Law of 1874. The protection, however, afforded by primary vaccination in South Germany resulted in the fatality in the South German States being much less than in Northern Germany, as is shown by the following table taken from Prinzing (1931, 649-650):—

DEATHS FROM SMALLPOX

	Population, December 31, 1871	1869	1870	1871	1872	1873
Prussia	24,691,085	4,655	4,200	59,839	16,660	8,932
Bavaria	4,863,450	456	516	5,070	2,992	869
Saxony	2,556,244	?	?	9,935	5,863	1,772
Würtemberg ...	1,818,539	133	529	2,050	1,164	55
Baden	1,461,562	67	343	3,176	511	?
Hesse	852,894	20	248	1,028	167	3
Hamburg ...	338,074	20	83	3,647	323	3

Jochmann illustrates the benefit which Bavaria derived from compulsory primary vaccination by the fact that while the total number of deaths from smallpox during the period 1870-74 was 9,174 in Bavaria with a population of five million inhabitants, during the same period in Berlin with a population of 900,000 the number of smallpox deaths was 66,538. Thus four times as many smallpox patients died in Berlin as in Bavaria. On the other hand, although Bavaria was generally regarded as the best vaccinated country in Europe, owing to the care with which infantile vaccination was carried out, the inability of primary vaccination to protect an adult population from smallpox was shown by the fact that in 1871 Bavaria had 30,742 cases of smallpox, 95% of whom had been vaccinated, with 4,748 deaths.

In Germany, as elsewhere during the pandemic, the disease was characterized by a peculiar malignancy and in particular by the frequency of hæmorrhagic cases. Wunderlich states that whereas during the previous eighteen years the smallpox mortality at Leipzig had been only 4·25%, in the 1871-72 epidemic it was nearly 14·7%. It is noteworthy that Leipzig was a town where the anti-vaccinationists had been remarkably active and successful in their campaign prior to the outbreak of the epidemic. It is obvious from the above description that the civilian population

of Germany suffered very heavily from smallpox during the epidemic, in striking contrast, as we shall see, with the Army which escaped comparatively lightly. The epidemic in Germany outlasted the war and the repatriation of the French prisoners for some time, and finally came to an end in 1874, after causing more than 170,000 deaths throughout the German Empire (Prinzing).

The severity of the losses sustained by Germany during these five years led to the passing in April 1874, of a law applicable throughout the Empire which enacted that every child must be vaccinated within two years of birth and that revaccination should be performed in the twelfth year. The result of this law has been that no widespread epidemic has since occurred in the country, although there were limited outbreaks in North Germany during and immediately after the war.

German Army.—In striking contrast with the civilian population, the German Army in 1870 was remarkably well vaccinated, vaccination and revaccination having been made compulsory in 1835, though they were not always carried out with sufficient thoroughness. At the beginning of the war the Army was almost free from smallpox, the total number of cases in July 1870 being only seven. The cases, however, rapidly increased in number after French territory had been invaded and reached their height in January and February 1871, after which they began to fall. The incidence and fatality of the disease varied in different parts of the Army according to their degree of exposure to infection. Official reports showed that troops employed in sieges as well as those in front-line positions, bivouacs, and deserted areas kept relatively free from smallpox, whereas the cases increased when the men had to shift their quarters frequently (Kübler). The troops fighting against the French Army on the Loire, and Bourbaki's forces in the south-west and south-east of France had an incidence of 7·8 per 1,000 strength, whereas the Army investing Metz had less than 0·5 per 1,000 attacked. The Bavarian Army, which was fighting on the Loire had a much higher incidence (1,128 cases and 56 deaths) than the Saxon contingent (262 cases and 29 deaths) which remained constantly before Paris and was less exposed to infection. The Hessian troops had the highest mortality, viz., 22·38 per 10,000 strength as they were first fighting on the Loire, and afterwards in the south-western theatre of war and were less efficiently vaccinated than the Bavarians. In the Prussian Army the Westphalian Corps suffered most with 282 cases (97·38 per 10,000) and 21 deaths, the cause for this being that they had had to escort the French prisoners captured in Metz where smallpox was rife (Kübler).

The incidence of smallpox in the immobile home forces which consisted mainly of elderly men whose revaccination dated many years back, or of young men who had been vaccinated too late, was everywhere higher than in the field troops whose vaccination state was satisfactory. According to Colin, among the hundreds of German prisoners in Paris, only one was sent to the Bicêtre Hospital as a case of smallpox, and his attack was so mild that the diagnosis was doubtful, whereas among the 372,918 French prisoners in Germany, 14,178 contracted smallpox, and 1,963 or 13·8%, died (Kübler).

During the whole epidemic the total number of smallpox cases in the German Army amounted to 8,463 cases and 459 deaths—a fatality of 5·43% (Jochmann).

Although the incidence and fatality of smallpox were much less in the German than in the French Army during the epidemic, infections such as enteric fever and dysentery levied a much heavier toll among the Germans than among the French (Immermann). This in itself is a sufficient reply to those who are inclined to attribute the lesser incidence of smallpox in the German Army not to its true cause, viz., better protection by vaccination, but to superior hygienic conditions. It is an equally mistaken idea to attempt to explain the disproportionately heavy losses from smallpox in the French Army by the mental and physical depression caused by repeated defeats and consequent diminished resistance to infection. For several

years before the war the mortality from smallpox had been much higher in the French than in the German Army, owing to the careless way in which vaccination and revaccination had been carried out. During the period 1866-69, there had been 380 deaths from smallpox in the French Army, of which 69 had occurred in 1869 alone, whereas only 77 deaths had been due to this cause in the Prussian Army during the 35 years following the introduction of compulsory vaccination in 1835.

Belgium.—Of the other European countries in which vaccination was not compulsory, Belgium was the first to suffer, the infection being conveyed partly by refugees after the German invasion of France, and partly after the battle of Sedan, by more than 10,000 French soldiers who were interned in the Beverloo camp and citadel of Antwerp (Vacher). Henceforward the disease spread throughout the country, causing a total of 35,931 deaths during the years 1870-1873, a poor reward, as Vacher remarks, for the Belgian hospitality.

Holland.—This country also paid a heavy tribute to smallpox during the pandemic. The disease first assumed epidemic form in Holland in November 1870, and then spread rapidly. In 1871 the total smallpox deaths amounted to 15,787, or 4·3 per thousand inhabitants, of which 7,734 were in children under 5 years. In 1872 the epidemic began to decline, the deaths amounting to 3,731, or above 1·3 per thousand of population, of which 1,662 were in children under 5. Seaton, from whom these figures are taken, points out that the smallpox rate in Holland in the year of the decline of the epidemic was as high as that of England when the epidemic was at its height. The provinces most affected were North Holland, South Holland and Utrecht, and the towns which suffered most were Utrecht, Rotterdam, Amsterdam and The Hague. Utrecht formed the centre of the epidemic, the spread of which was furthered not only by the unsatisfactory vaccination state of the inhabitants, but also by neglect to isolate those actually suffering from smallpox and by their premature discharge from hospital. In the Rijks Hospital in Utrecht, according to Kübler, smallpox patients were treated in the general wards with the other patients. In the towns the mortality was twice as high as in the rural districts. It should be noted that not only was vaccination not compulsory until admission to the communal schools, but according to the official reports vaccination in the first years of childhood was shamefully neglected (Kübler).

Switzerland—in which vaccination was also not compulsory—became infected about the same time as Belgium, and in a similar manner as the result of interned French soldiers incubating or actually suffering from the disease being distributed throughout the cantons and the close intercourse between these men and the inhabitants. The western cantons were most exposed to infection (Prinzing). The towns chiefly affected were Zurich, Basel, Bern and Geneva. The disease was mainly introduced by the entrance into Switzerland, in February 1871, and consequent internment of the remains of Bourbaki's army consisting of 11,533 men and 450 officers among whom there were numerous smallpox cases (Kübler). The disease first appeared in Bern in September 1870. In the following December there were 39 cases, in January 1871, 204, in February 387, and in March 470. The total number of cases in the canton from October 1870 to September 1873 was 2,748.

Basel was first attacked in November 1870. In 1871 it had 450 cases and 64 deaths, and in the following year about 100 cases and 13 deaths.

In the Canton of Zurich the population of which numbered 284,000, excluding 180 interned French soldiers, 412 per 100,000 inhabitants contracted smallpox during the period June 1870 to June 1872. Of these 923 were treated in hospital and 129 (13·9%) died.

Geneva also suffered from a severe epidemic (Kübler).

Italy.—As in several of the other European countries I have mentioned smallpox was already present in Italy before the outbreak of the Franco-Prussian war, particularly in Genoa, Turin, Florence and Milan, but a considerable increase in its

incidence took place subsequently mainly as the result of the return of Garibaldi's volunteers who had been fighting for the French and had been infected with smallpox in the Côte D'Or. In Rome where smallpox first appeared in October 1871, 325 deaths from the disease occurred between October 10 and December 31, 1871, and 721 in 1872 (Prinzing).

It should be noted that Italy did not have any vaccination law until 1888 when infantile vaccination and revaccination on entering school were made compulsory (Edwardes, 1896).

Austria.—Prinzing has drawn attention to the fact that there was a very marked difference in the behaviour of the epidemic in Germany and East Austria. Whereas in Germany the whole country was attacked within a very short time, in Austria the progress of the disease was much slower. Moreover, the epidemic was more fatal than in Prussia. It did not reach its height in the German provinces of Austria until 1872, and it then extended eastwards and southwards into Hungary and the Banat where it culminated in 1873 and finally came to an end in 1874 (Keller).

Vienna and Prague were the towns in which the losses were heaviest. In Vienna there were 52·7 deaths per 10,000 inhabitants in 1872, and in Prague 39·7 per 10,000 in the same year (Prinzing). According to Kübler during the quinquennium 1870-74 there were 155,335 deaths from smallpox in Austria, of which 141,088 were in the last three years of that period.

The losses from smallpox in the Austrian Army, which of course was not engaged in the war of 1870-71, were considerably higher than in the German Army—a further proof, if one were needed, that the fatigues and privations of war are not sufficient to cause a great increase in smallpox.

It is noteworthy in this connection that while the deaths from smallpox in the English Army during each of the years 1870-74 were 1, 23, 14, 1 and 0 per 100,000 of strength, the deaths in the Austrian Army during the same period per 100,000 were 17, 40, 101, 100 and 67 for the corresponding years (Edwardes, 1902). Immermann has noted that the lax vaccination and revaccination conditions in Austria continued almost unchanged after the pandemic. According to Prinzing (1931, 496) it is only on admission to school that a vaccination certificate is required in that country.

Scandinavia.—Some time elapsed before the pandemic reached Scandinavia. In Denmark smallpox did not become widespread until 1872, when 1,220 cases with 86 deaths occurred between January and April (Prinzing). The number of deaths for the whole kingdom was 108 in 1871 and 381 in 1872, of which 23 and 218 respectively were in Copenhagen alone (Seaton). Of the 241 deaths which took place in Copenhagen 85 were in persons under 15 years of age.

In Sweden there had been an epidemic of smallpox during the years 1865-69. with the result that in 1870-72 the country was little affected, and it was not until December 1873 that the disease again appeared in epidemic form. In 1874 it caused 4,063 deaths, 1,206 of which were in Stockholm alone which had a population of about 150,446—a mortality of over 8,000 per million inhabitants. Edwardes (1896) attributes this enormously high rate in spite of compulsory vaccination having been introduced seventy years previously to the fact that Stockholm in which 49% of the children were unvaccinated was far behind the rest of the country in observance of the law. During the period 1873-1875 there were 7,204 deaths from smallpox in Sweden. Norway which was visited by an epidemic of smallpox simultaneously with Sweden in 1865-1868, when 6,620 cases occurred with 445 deaths (6·7%), was again attacked in the early 'seventies, but less severely than Sweden, only 2,235 cases with 275 deaths (11·6%) being reported during the period 1870-1875 (Low).

Finland.—In Finland where there had been an epidemic in 1868 the smallpox

mortality in 1870, 1871 and 1872 per 10,000 inhabitants was 1·3, 1·0 and 3·4 respectively, but during the next two years it rose to 45·6 and 50·1, falling in 1875 to 8·6, and in 1876 to 3·6 per 10,000 (Prinzing).

As regards the other European countries, Seaton and Kübler agree in stating that Russia, Spain and Portugal suffered severely, but do not supply any statistical information beyond the statement given by Seaton that between April 13, 1872, when smallpox was first officially notified, and June 24, 1873, 1,850 deaths were reported at St. Petersburg.

United States.—As the result of emigration the disease was carried to America, where 293 deaths from smallpox occurred in New York in 1870, and 805 in 1871 (Prinzing). In Boston the epidemic was still more severe, as according to Webb 3,722 cases with 1,026 deaths—a fatality rate of 27·56%—were reported in that city between January 1, 1872, and May 1, 1873. Of 1,252 cases treated in hospital, 7·58% and a still larger proportion of those treated in their own homes were of the hæmorrhagic type.

In his Presidential Address to the Epidemiological Society at the opening of the 1872-73 session, Inspector-General Robert Lawson drew attention to the recent prevalence of hæmorrhagic forms of smallpox in Trinidad, as well as in this country, the Continent of Europe, the United States and Canada. He also alluded to the occurrence of smallpox epidemics in the island of Teneriffe in August 1870, and in Japan in December 1870, when the outbreak was very severe. Serious epidemics also occurred in 1871 on the Gold Coast, Bushire, Ceylon and the Straits Settlements, and in 1872 in San Francisco, Honolulu, Wellington, Melbourne and Santiago and Valparaiso in Chili, and in almost every district of South India. As, however, epidemics in these countries were frequent at all times the influence of the European pandemic on their occurrence cannot be proved.

Although this survey has contained several references to the comparative mortality in the different countries of the vaccinated and the unvaccinated during the pandemic, it is well in conclusion to lay before you some further statistics.

E. J. Edwardes (1902) has drawn up figures for the period 1870-75 showing the comparative deaths from smallpox per million living in: (A) Four countries in which vaccination was compulsory, viz., England, Scotland, Bavaria and Sweden; and (B) four countries in which it was not, viz., Prussia, Austria, Belgium and Holland.

Average rate for (A) Group, 1870-75.—England 361, Scotland 314, Bavaria 346, Sweden 333.

Average rate for (B) Group.—Prussia 953, Austria 1,360, Belgium 1,293, Holland 958.

The following figures are taken from a "Report of a Committee of the Managers of the Metropolitan Asylums District with statistics as to the cases of smallpox treated in their several hospitals during the smallpox epidemic of 1870-71-72."

Of 14,808 cases admitted up to March 30, 1872, 11,174 cases were reported as vaccinated with a mortality rate of 10·15% and 3,634 unvaccinated with a mortality of 44·80%. The death-rate of the whole number was 18·60%.

Similar figures were returned by Marson for the Highgate Smallpox Hospital (Letheby). Moreover, in upwards of over 14,800 admissions to the M.A.B. Hospitals during the epidemic there were only four well-authenticated cases in which revaccination had been properly performed and these were slight attacks.

There appears to be little doubt that the incidence of the disease among the vaccinated would have been lower still if the operation had always been properly performed. At a meeting of the Epidemiological Society on March 8, 1871, the President, Dr. Seaton, dwelt on the imperfect, slipshod style of much of the vaccination that was done and expressed his belief that in the present epidemic we were paying the penalty for the loose method (*Lancet* 1871 (i), 350). I have

previously referred to the slovenly way in which vaccination was carried out in the French Army.

In Germany the difference in the fatality rates of the vaccinated and unvaccinated was also very pronounced. According to McVail (1919) the mortality among the unvaccinated in the Berlin hospitals was 81·25%, and among the vaccinated 14%. Prinzing (1931) quotes Flinzer's figures at Chemnitz where there was a fatality rate of 0·7% among the vaccinated as compared with 9·2% among the unvaccinated. In the Leipzig hospitals, according to Wunderlich, out of 1,727 patients under treatment up to February 20, 1872, 139 were unvaccinated and had a mortality of 99 (71%) and 1,504 vaccinated, and showed a mortality of 116 (only 8%) while none of the 13 revaccinated died. It is noteworthy that of 22 who had previously had an attack of smallpox six died. According to von Pastau in Breslau, which suffered severely in 1871-72, of 1,184 unvaccinated patients 484 (40·98%) died, while among 5,523 vaccinated there were 690 deaths (12·67%).

In Bavaria out of 30,742 cases of smallpox 29,429 were vaccinated, and of these 3,994 died—a fatality rate of 13·8%, while among the 1,313 unvaccinated 790 died, of whom 743 were infants under 1 year, a fatality rate of 60·1% (Majer).

In Switzerland no vaccinated person under 19 died of smallpox during the epidemic (Lotz, quoted by Edwardes 1902).

In no section of the community was the value of revaccination more clearly demonstrated during the pandemic than in the nursing and medical staff of smallpox hospitals. According to Seaton not one of the M.A.B. officials, amounting at one time to over 300, who had been revaccinated before taking up duty contracted the disease. The immunity of the well-vaccinated M.A.B. staff in subsequent epidemics and particularly during the severe epidemic of 1901-2 has always been the rule.

Edwardes (1902) has also noted the fact that out of 10,000 employees on the Post Office staff, all permanent members of which have to be vaccinated on joining unless there is evidence of successful vaccination within the last seven years, not one died of smallpox in the 1871-72 epidemic, and there were only ten slight cases.

Many writers have dwelt on the shifting of the incidence and mortality of smallpox from childhood to adult life in the first half of the nineteenth century, the epidemic of 1837-41 being the last to show a preponderating proportion of deaths among infants and young children. While, however, it is generally held that the change in age-incidence is due to a better enforcement of vaccination in early life Creighton attributed it to an epidemiological obsolescence of the disease. This writer, however, appears to ignore the fact that in those countries where vaccination was not compulsory the infantile mortality from smallpox during the pandemic was much higher than in those in which vaccination was more or strictly enforced. This is clearly shown in the following table (Edwardes 1892, 42).

	Smallpox rate per 100,000	The deaths under 5 years form the following percentages of death at all ages	Prevailing Vaccination Laws
Holland, eight chief towns 1871-72	1,009	60·7	No general vaccination law. Indirect compulsion at school age
Prussia, Berlin, and Leipzig, 1870-72 ...	772	46·6	Law only nominal for infants. Practically no compulsion till school age
London, 1871-72... ...	292	36·7	Imperfect but improving machinery of law
17 unions, 1871-72 ...	312		
Scotland, eight chief towns 1871-72	223	23·7	More efficient law

In conclusion, it may be stated that there is no evidence that the sanitary conditions in Belgium, Holland and Austria which suffered most from the pandemic

were more unfavourable than in the United Kingdom, South Germany or Sweden, which suffered least, whereas the lower smallpox mortality in the last named countries can be readily explained by their better vaccination state.

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(Except where otherwise dated the quotations from Prinzing are from his book of 1916 and those from Seaton from his article of 1875.)

Section of Physical Medicine

President—M. B. Ray, D.S.O., M.D.

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The Arthritic Hand

PRESIDENT'S ADDRESS

By M. B. Ray, D.S.O., M.D.

The finger-joints being wholly subcutaneous and easily accessible, articular changes can be studied in the hand with greater facility than in any other part of the body.

Changes in the hands associated with the more common forms of arthritis and peri-arthritis are dealt with, viz.: rheumatoid arthritis, infective or "metastatic" arthritis, osteo-arthritis, gout and peri-articular fibrositis.

Rheumatoid Arthritis

Premonitory symptoms are much more commonly found in rheumatoid arthritis than in metastatic or infective arthritis. The symptoms vary greatly in degree and consist mainly of vasomotor disturbances—local syncope or asphyxia, in some respects resembling Raynaud's disease; motor phenomena—cramps, weakness or wasting of certain groups of muscles, mostly concerned with the movement of the affected joints; sensory symptoms—paræsthesia, numbness, tingling, "pins and needles," etc. The occurrence of these disturbances may ante-date the appearance of the actual joint changes by six months or even longer.

The Wrist-joint.

Clinical features.—Peri-articular effusion combined with moderate synovial distension produces a dome-like swelling on the back of the wrist which gives rise to that spindle or fusiform shape so highly characteristic of rheumatoid or infective joint conditions.

Coincident with the enlargement of the wrist there is frequently a deep-seated tenderness over the articulation between the first metacarpal and multangular bones. Stiffness in the basal joint of the thumb naturally leads to the impairment of the usefulness of the hand as a prehensile member, particularly if it is fixed in a rigid adducted position so that its opposition to the fingers is interfered with.

The atrophic state of the extensors which practically always accompanies an arthritis of the wrist results in over-action, spasm and eventual shortening of the flexors which is very apt to produce a permanent palmar flexion which greatly impedes the grasping power of the hand. It will be remembered that the strongest grip is obtained when the wrist is in the position of slight dorsi-flexion.

Owing to the relaxation of the radial collateral ligament, from distension of the underlying articular cavities, the whole hand deviates towards the ulnar side. Gowers says this may be due to paralysis of the long radial extensor.

Diagnosis.—The condition is quite easy of recognition when it forms part of a more or less generalized polyarthritis of symmetrical type. The sex, age and general appearance of the patient are usually quite distinctive. A mono-articular affection of the wrist is generally of infective origin and the possibility of a gonococcal infection must not be lost sight of.

The Hand.

Clinical features.—Just as a definite "rheumatoid" type of patient is recognized—usually a woman in the third or fourth decade—slender limbed, long backed, and with a narrow costal angle, a pale muddy complexion, and often freckles and bronzed pigmentation over the forehead; in like manner the hand as a whole presents distinctive features—long, narrow, and tapering, with cold, clammy and amorphous fingers, streaming with perspiration.

In the early stages an examination of the mid-phalangeal joints of the second and ring fingers and possibly the thumb will reveal fusiform or spindle-shaped swellings. The proximal phalangeal joints of the index and second fingers will be involved in course of time but the condition has a distinct tendency to begin in the articulations first mentioned.

The terminal phalangeal joints undergo no enlargement—a diagnostic feature of importance. This, however, does not prevent them from being affected by atrophic changes and fixation in distorted positions in the later stages of the disease.

Over the enlarged fusiform joints, the skin has a pale white waxy appearance or it may be semi-asphyxial in colour. Owing to the swelling of the subjacent tissues, it seems tight and almost transparent.

On palpation the swollen joint feels tense and elastic. Actual fluctuation is not common, as there is rarely any great excess of fluid within the joint cavity, the increase in size being mostly due to capsular swelling and peri-articular effusion. Lateral movement of the two bone-ends gives a grating sensation, in all likelihood caused by loss of cartilage. The smooth fusiform contour of the affected joints may be found in other forms of arthritis but the symmetrical distribution of the articular changes is characteristic of rheumatoid arthritis. Many writers make a great point of the centripetal involvement of the joints. This is by no means applicable in a large number of instances. The wrist may be implicated before the fingers and it is by no means uncommon to find the condition beginning in the ankle-joint.

One of the most striking features of the rheumatoid hand is the extensive wasting of the muscles. Perhaps the earliest sign of the onset of this condition is the wasting of the interossei which gives the characteristic "spoon shape" to the back of the hand. Muscular wasting is frequently to be observed before any of the joints are actually implicated.

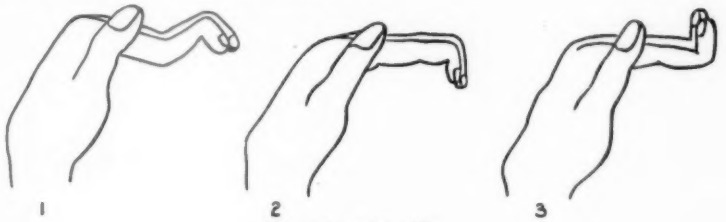
With the wasting of one group of muscles, its antagonists will exercise an increased pull on the bones entering into the joints. This will of necessity cause considerable distortion, particularly if the overacting muscles undergo a process of shortening which they are extremely apt to do. The reason why this distortion occurs so freely in rheumatoid arthritis is that the bone-ends are not enlarged in any way, the changes being confined, at any rate in the early stages, to the synovial membrane and articular capsule. A very small amount of fluid within a joint will cause the two opposing articular surfaces to become separated and the unopposed action of any particular group of muscles will give rise to either an extension or flexion deformity as the case may be. It was pointed out by Charcot many years ago that the amount of distortion is to some extent inversely proportional to the enlargement of the head of the bone.

The state of the interossei has a considerable influence on the type of deformity and resulting contractures that occur in rheumatoid arthritis. It will be remembered that these muscles acting with the lumbricales flex the proximal row of phalanges upon the metacarpals and extend the two distal rows.

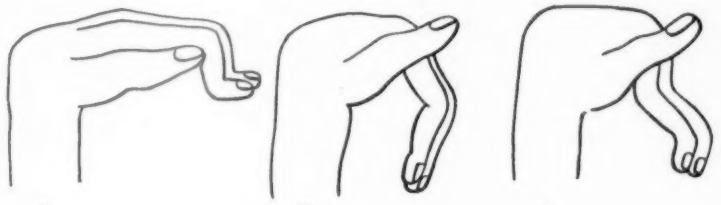
Charcot classified the deformities of the hands into two types, extension and flexion.[1] Strong interossei, by their pull on the two distal rows of phalanges, tend to

[1] See A. B. Garrod: "Gout and Rheumatic Gout," 3rd. ed., 1876, p. 52.

an extension deformity, while weakness of these muscles results in others overpowering them and a flexion distortion is thus produced.



Extension deformities.



Flexion deformities.

Llewellyn and others consider that there is a tendency for the incidence of the joint affections to follow a segmental arrangement; for example, the first joints to be involved may be the mid-phalangeal of the second and ring fingers and this symmetrically, while in other instances the swellings first appear in the thumb and index fingers of both hands.

This observation also applies, to some extent, so far as the dystrophic changes in the muscles are concerned. It will be remembered that a lesion in a single nerve picks out all the muscles it supplies, whereas if only one muscle or group is picked out the inference is that the lesion is in the cord or nerve-root. There is therefore some reason to assume that in those cases in which atrophic changes appear to be more or less confined to the interossei the lesion may be in the neighbourhood of the 8th cervical root or adjacent region in the cord. It will be recalled that when a cervical rib is present, the muscular atrophy is mainly confined to the interossei.

It has already been noted that atrophy of the interossei may occur before there are any signs of joint involvement. It has been repeatedly observed that joints that apparently remain free from rheumatoid changes may become fixed, distorted or even dislocated, thus showing that the correlation between muscular dystrophy and joint affection is by no means fully established. It is only in rare instances that the atrophied muscles show a reaction of degeneration. Myotatic irritability is frequently a marked feature and can often be found in all the muscles of the body.

Ulnar deviation of the fingers at the metacarpo-phalangeal joints is very common in rheumatoid arthritis and is so marked in some instances as to cause a partial sub-luxation at these joints. According to Barnes Burt, there is first a forward sub-luxation and this, combined with the natural tendency of the fingers to deviate towards the ulnar side, as well as the weight placed on the radial side of the hand as the patient rises from a chair, accounts for the deformity.

Later stages.—The characteristic fusiform enlargements of the joints do not persist but undergo a gradual shrinkage. These atrophic changes are to be found not only in the joints themselves but in the overlying skin. At this stage it is no

longer possible to pick up the skin over the joint. The loose skin over the knuckle gives place to a thin, tightly stretched glossy integument which seems to be an additional impediment to the mobility of the joint. Eventually the two bone ends become fixed in either flexion or extension or in a straight line by firm osseous union. This is quite unlike the ankylosis that may take place as a result of an ordinary joint infection. In some instances the two bone-ends almost telescope, one into the other, and it may be difficult to say where the original joint was. The changes just outlined apply more particularly to the distal and mid-phalangeal joints. The proximal phalangeal joints may become fixed but this takes place much later. In many instances they escape altogether. This is accounted for by the fact that these joints—more especially the first two—are kept moving to a much greater extent than the others. This circumstance provides a cogent reason for the encouragement of patients to keep their fingers as mobile as possible.

Collateral symptoms.—The joint changes in rheumatoid arthritis, serious and disabling as they are, do not make up the entire clinical picture. The fact that rheumatoid arthritis is a systematic disease with articular manifestations places it in a class apart from the infective group of arthritides to be considered later. Among the constitutional changes may be mentioned achlorhydria and hypochlorhydria, degrees of secondary anæmia, enlargements of the lymphatic glands and a palpable spleen.

The vasomotor disturbances, motor phenomena and sensory symptoms briefly referred to as forming the prodromal stage in this condition, persist to a greater or less extent after the onset of joint changes, and it is only when the quiescent or terminal stage is reached that these symptoms finally disappear.

Radiological changes.—Gilbert Scott describes three stages, viz.:—

(1) A general osteoporosis or loss of bone calcium.

(2) Loss of cartilage in several of the finger-joints and possibly in the wrist.

(3) Erosion of the articular bone under the cartilage, generally with sub-luxation, disorganization and fibrous or bony ankylosis.

Diagnosis.—Perhaps the chief difficulty lies in the differentiation between rheumatoid arthritis and infective or metastatic arthritis. This is dealt with in tabular form at the end of the section devoted to the consideration of the latter condition.

There are, however, certain other affections associated with dystrophic changes in the hands and fingers which might in their early stages be mistaken for incipient rheumatoid arthritis; for example, progressive muscular atrophy, cervical rib, syringomyelia, progressive neurotic amyotrophy (Charcot-Marie-Tooth) or some types of thenar and hypothenar neural atrophy.

Infective Arthritis

A group designation of joint changes ætiologically distinct from those of rheumatoid arthritis, in that they are associated with the presence of specific or non-specific organisms. All grades of intensity are to be met with, from the frankly suppurative arthritis of the pyogenic streptococci, through the varying grades of the pneumococcus, the gonococcus and the tubercle bacillus, to a non-suppurative group which is arbitrarily included among the rheumatic affections.

Various names have been applied to the latter: chronic non-specific infective arthritis; infective arthritis of undifferentiated type; focal arthritis; proliferative arthritis and metastatic arthritis.

While no causal organism has yet been fully identified with the production of this form of arthritis, the non-pyogenic streptococcal group is regarded as the most likely. It will be remembered that over 150 possible kinds of streptococci, and an almost infinite number of antigenic races, are credited with the causation of arthritis. Taking the two groups into which the streptococci are divided—hæmolytic and non-

hæmolytic—the former include those which produce septicæmia, abscesses, erysipelas and the more severe forms of streptococcal infection, while the latter include the "viridans" type. Many of the non-hæmolytic types can be cultivated indifferently from any infected area in the mouth, teeth, tonsils, sputum, fæces, prostate or vagina. A culture taken from the mouth of a normal individual will provide a large number of different types, all apparently perfectly harmless.

It is assumed (adequate proof is wanting) that if any of these apparently harmless streptococci gain access to the blood-stream; their virulence may be raised or they may produce their ill-effects when the resistance of the tissues is lowered.

The Wrist.

Clinical features.—The actual joint changes—a dome-like swelling on the back of the wrist which may be more prominent over one or other styloid process—very much resemble those found in rheumatoid arthritis.

There is a tendency for the affection to be confined more or less to one side, chiefly the right, owing no doubt to the greater strain to which this joint is exposed, whereas in left-handed people the wrist on that side seems to be involved more often. The condition may exist without any involvement of the fingers.

The onset is usually slow and insidious, and is generally attributed to a strain which it frequently resembles in the early stages. Patients complain of pain and a feeling of weakness in all attempts to use the joint. The extensor muscles on the back of the arm undergo a certain amount of wasting which renders the swelling on the back of the wrist more prominent.

Diagnosis.—The diagnosis rests mainly on the absence of a symmetrical involvement of other joints. In young subjects the possibility of a tuberculous arthritis has to be kept in mind, while a gonorrhœal mono-arthritis in this situation is by no means uncommon. In older people a degenerative arthritis is sometimes found in the wrist, especially if the joint has been exposed to unusual strains.

The Hand.

Clinical features.—An infective arthritis affecting the finger-joints is more of a local condition than rheumatoid arthritis in similar situations. While there may be some malaise and pyrexia during its inception there is no train of prodromal symptoms that characterize the onset of rheumatoid arthritis. The type of patient is in no way distinctive—men are affected quite as often as women, if not oftener. The age of incidence may be anything from twenty to fifty or even later.

The type of hand presents no distinguishing features. An infective arthritis is just as likely to be found in a short, "stubby," spatulate hand as in one of more slender type. There is not that cold, flabby amorphous feeling when the hand is clasped. In many instances it feels quite warm and natural. The sweating rarely exceeds that found in quite normal individuals except that there is a tendency for an excessive amount over the affected joints.

There is frequently a more or less simultaneous implication of two or three of the mid and proximal phalangeal joints of both hands, while the other joints may remain practically free. There is rarely that progressive involvement of both hands leading to permanent contractures that is so characteristic of the true rheumatoid condition. The skin overlying the joints does not as a rule undergo the atrophic changes seen in the other affection. The actual joint changes are very similar in their early stages to those of rheumatoid arthritis. The swelling is fusiform or spindle-shaped and may be tense and fluctuating on palpation. Lateral pressure is painful.

In common with arthritic conditions in all situations there is a certain amount of muscular wasting. This mainly affects the muscles in direct relationship to the joint. The wasting of the extensors may allow a puffy swelling to appear on the

back of the hand due to distension of the synovial sacs. There is also some wasting of the interossei, which, however, does not make its appearance as quickly as it does in rheumatoid cases. It will be remembered that in rheumatoid arthritis the atrophic state of the muscles is frequently out of all proportion to the extent of joint involvement. In other words, the wasting in infective arthritis is mainly from disuse, whereas in rheumatoid arthritis it is part of the general condition.

If the proximal phalangeal joints are involved to any marked extent there may be some ulnar deviation, but it is not common. A symmetrical ulnar deviation at these joints is much more characteristic of a rheumatoid arthritis than of an infective arthritis.

The effect of treatment is a distinguishing feature in these cases. If some discoverable focus of infection is adequately dealt with or removed, the swelling in the fingers subsides and the joints once more resume their normal contour. This is well seen in some cases of gonococcal arthritis of the fingers. If the underlying cause is properly treated, the swelling gradually disappears and beyond a little stiffness the finger may regain its functional use.

Later stages.—In the later stages where the focus remains untreated or undiscovered, ankylosis may occur, but it is much more likely to be fibrous rather than bony. Atrophic changes in the skin and constituents of the joint do not occur to the same extent that applies in rheumatoid conditions. There is not the same "telescoping" of the bone ends and if ankylosis does take place the contour of the joint still remains. There may be considerable distortion of the joint, but contractures of all the fingers so often seen in the terminal stages of rheumatoid arthritis is not a feature of an ordinary case of infective arthritis.

Radiological changes.—There are no general bone changes. The bone ends may show some local osteoporosis as evidenced by increased translucency. In the lower limb there may be some sclerosis at the points of maximum pressure. There is frequently an early formation of osteophytes while actual bone erosion is a late manifestation.

Differential Diagnosis between Rheumatoid and Infective Arthritis.

	Rheumatoid arthritis	Infective arthritis
Causation (focus of infection)	Focus rarely if ever discoverable	Focus usually present
Prodromal symptoms	Present	Usually absent
Type of patient	Slender, long-backed; narrow costal angle	No particular type
Sex and age	Mostly women during the child-bearing epoch	Men as often as women. Age, 20 to 50
Type of hands	Long, thin, with tapering fingers	No special type
Joints affected	Mid-phalangeal with extension to others	May remain more or less localized to mid-phalangeal joints
Skin over joints	Waxy, white, transparent	No marked change
Sweating of hands	Whole hand sweats	Chiefly over affected joints
Character of joint-changes	Fusiform or spindle-shaped. Peri-articular effusion. Tense and elastic on palpation	Fusiform or spindle-shaped. Peri-articular effusion
Symmetry of joint affections	Symmetrical	Not always symmetrical
Centripetal affection of joints	Tendency	No tendency
Muscular atrophy	Very marked. Often quite independent of joint changes	Only muscles concerned in movements of affected joints
Contractures	Prominent feature	Not prominent
Ulnar deviation	Very common	Not a feature
Collateral symptoms	General constitutional disturbance	No marked constitutional disance
Terminal stage	Ankylosis, atrophy and often "telescoping" of bone-ends	Often fibrous ankylosis. Bone-ends do not tend to atrophy so much
X-ray appearances	Eburnation of cartilage. Disturbance of bone density balance throughout whole of bone	Atrophic changes mainly at bone-ends. Eburnation of cartilage much later

Osteo-arthritis

Osteo-arthritis is essentially a disease of the middle and later decades of life, and is frequently associated with degenerative conditions that are apt to first show themselves at that time.

It seems to be connected in some way or another with old injuries. Some observers consider the condition to be due to a "bradytrophy," i.e., sluggishness of metabolism, an expression of premature exhaustion or a premature ageing of the endocrine system.

The Wrist.

Clinical features.—An osteo-arthritis of the wrist is more commonly found in elderly people, and may at first be mono-articular, but it is usual to come across similar changes in one or two other joints at a later period. There is frequently an association with some old injury or strain, often forgotten until the onset of joint changes.

Many writers have drawn attention to the frequency with which the carpo-metacarpal joint of the thumb is affected. A similar observation was made with regard to this region in rheumatoid arthritis, and in both conditions a deep-seated tenderness here may be looked upon as an early sign.

The affection is usually insidious in its beginning, and, beyond the tenderness just mentioned, very little pain is experienced, the chief disability being a gradually increasing stiffness. There may be some initial swelling and distension of the synovial sacs in the neighbourhood, but the joint does not assume the fusiform contour so characteristic of rheumatoid or infective arthritis. It should be remembered that the enlargement is due to synovial distension and not to peri-articular effusion. Osteo-arthritic changes may be found in any of the bones entering into the joints of the carpus. For example, the os magnum and semilunar bones may present irregularities of their articulating surfaces, due to ridges of new bone deposited thereon, while bony excrescences are occasionally to be observed in relation to the lower ends of the ulna and radius.

Cochrane describes a broadening of the carpus as a whole, which takes place in elderly people, who, when rising from a chair, rest their weight on their hands. He points out that any increase in the breadth of the carpus causes the navicular bone to undergo a slight sub-luxation from its normal position, with the result that the metacarpal bone of the thumb is no longer in close contact with the trapezium, and a line drawn through its long axis, instead of passing as it should through the navicular, would occupy a position more nearly parallel to the other metacarpals and the bones of the forearm. This restricts the prehensile powers of the hand, and, as a remedy, he suggests the wearing of a leather wristlet to restore the normal carpal arch.

The Hand.

Clinical features.—The osteo-arthritic hand is frequently met with in elderly people of both sexes of a somewhat florid or robust type. It is also very common in women at or about the time of the menopause, and is associated with that variety of osteo-arthritis, usually known as villous arthritis, which chiefly affects the knees. Beyond saying this, its incidence cannot be correlated with any special type of individual.

Neither do the hands themselves present any characteristic feature. When grasped they usually feel firm, warm and healthy, and in most ways distinct from the cold amorphous clammy fingers of the rheumatoid arthritic subject.

While the mid-phalangeal joints are the seat of election in both rheumatoid and infective arthritis, the terminal joints of the fingers are much more apt to be affected in osteo-arthritis.

Deflection towards the radial side is extremely common at the terminal phalangeal joint. This is most likely due to bony outgrowths on the ulnar side of the bone.

The distortions due to atrophy and spasmodic conditions of the muscles, so common a feature of rheumatoid arthritis, are not met with in osteo-arthritis. Displacement of the articular surfaces of any of the finger-joints is purely mechanical. Enlargements are not entirely confined to the terminal phalanges but occur in the mid-phalangeal and proximal phalangeal joints fairly often. These joint swellings are not fusiform or spindle-shaped, as the changes are inter-articular and not peri-articular, as obtains in rheumatoid and infective arthritis. The enlargement is, at any rate at first, due to synovial distension and this, in the absence of periarticular effusion, causes its contour to be bulky and irregular. There may be some fluctuation but the bony irregular outline can be made out through the fluid that may happen to be present.

Atrophic changes do not take place in the bone-ends. The longer the process has been in operation, the greater the extent of bony enlargement and deformity.

Theoretically, ankylosis does not occur in osteo-arthritis, any limitation of the normal range of movement being due entirely to the mechanical obstruction of the bony outgrowths or to "locking" of osteophytes. Lawford Knaggs, however, states that in some of Strangeway's specimens he has found evidence of both bony and fibrous ankylosis in the mid-phalangeal joints.

Diagnosis.—The diagnosis of the osteo-arthritic hand is not difficult. The irregular contour of the articulations, the radial deflection of the terminal phalanges, the absence of atrophic changes in the muscles and the general appearance of the patient all contribute to its ease of recognition.

Heberden's nodes.—The characteristic nodes associated with the name of Heberden are frequently to be found at the lower part of the terminal phalanges. Writing of them in 1805, he says :—

> "I have never clearly understood the nature of the small tumours about the size of a pea, which sometimes form near the third joints of the fingers; they have certainly nothing in common with gout, for they are found in many patients who have no experience of the disease. They last through life, are painless, and have no tendency to ulcerate. They are rather disfiguring than inconvenient, although the movements of the fingers are somewhat hindered by them."

It will be noticed that the nodes are placed at the back of the joint. As most strains occur when the terminal phalanx is extended on the second, the two articular surfaces impinge at their posterior borders. They may therefore be regarded as an effort on the part of Nature to buttress a joint that is exposed to unusual strains. In quite a number of instances a definite history of a strain or injury to the joint while in this position has been obtained. In some respects they might be looked upon as an enlargement of the condyle of the phalanx.

As the nodes are frequently found in patients who present no signs of osteo-arthritic changes in any of their joints, there is a certain amount of doubt whether they can correctly be considered as one of the manifestations of the condition.

Radiographic changes.—According to Gilbert Scott, the earliest signs of osteo-arthritis are to be found in the hands. Minute thorn-like osteophytes grow from the edge of the articular surfaces of the fingers. In addition, there are often very small opaque bodies, deposited in the substance of the joint capsule itself and quite unattached to the bone, which he calls "peri-articular ossicles."

The terminal joints of the first and second fingers are mostly attacked and as the disease progresses the joint-surfaces become irregular or "dentate" and the joint-space disappears. Movement is, however, still possible.

GOUT

The acute form, in the hand, presents a striking similarity to what is often termed "classical gout" in the foot, viz., a sudden onset often during the early hours of the morning.

Its commonest situation in the hand is the first proximal phalangeal joint but it may occur in the wrist or metacarpo-phalangeal or the carpo-metacarpal joint of the thumb.

The affected joint is hot, tense and shiny, and if the knuckle is the seat of the inflammation, the whole of the dorsum of the hand becomes swollen and œdematous and pits on pressure. The skin over the swelling has a dusky appearance and the superficial veins are all dilated. The pain is intense and increased by the slightest pressure on or movement of the fingers.

The only condition for which it might be mistaken at its inception is an attack of acute rheumatism, but the absence of involvement of other joints and, in most instances, of any marked pyrexia is sufficient to clear the diagnosis.

The inflammation usually subsides in from five to ten days and is followed by desquamation of the skin of the part. The first few attacks clear up without leaving any trace. This is a diagnostic point of some importance, because other forms of arthritis affecting the hands are progressive and cause an increasing amount of disability.

Chronic Gout.

Clinical features.—While, as just stated, the first few attacks of acute gout leave no apparent trace, this does not apply for all time. With a continual succession of attacks involving the foot or ankle at one time and the hand or wrist at another, the tissues become less and less able to deal with and eliminate the uratic deposits precipitated therein.

As a consequence the finger-joints become chronically enlarged and at first present some similarity to the changes seen in osteo-arthritis. The enlarged joints, owing to the mechanical obstruction of the deposits and thickenings in the neighbourhood of their articular surfaces, become fixed in various positions of flexion and extension. Tophaceous swellings are also to be found, bearing no relationship to the joints. It is useful to remember that the difference between a small tophaceous swelling and a Heberden's node is that the former can be moved about while the latter is absolutely fixed. These tophaceous enlargements gradually increase in size until the whole hand presents a series of bulbous swellings which may quite obscure the knuckles and finger-joints. The skin over the tophi is glistening and has a dusky red appearance and is quite thin in places through which the white creamy contents of the swelling can be seen. The skin in these situations often gives way and allows the deposit to exude in small quantities. This is, of course, the well-known "chalky gout" which is so widely recognized that diagnostic difficulties do not often arise.

Diagnosis.—There may be some difficulty in diagnosis with regard to minor degrees of the condition. Chronic thickenings may perhaps be found on the first two proximal phalangeal joints as well as on the middle joints of the fingers. In women these might be diagnosed as rheumatoid arthritis, especially if similar changes happen to be present elsewhere. Careful inquiry might reveal that the patient has had a series of attacks, the earlier of which cleared up and only the later ones have persisted. Gout is very rare in women before the age of forty, but after that age it occurs with greater frequency than is perhaps realized; indeed, if radiological findings can be relied upon, the condition is by no means uncommon. If definite tophi can be found in any part of the body, the diagnosis is at once settled.

Radiographic appearances.—The deposition of sodium biurate crystals in the articular ends of the bones of the fingers gives rise to well-defined clear "punched out"

areas immediately under the cartilage. In the very early stages no articular changes are to be seen. There is no disturbance of the bone-density balance, a circumstance which serves to distinguish gout from rheumatoid arthritis.

Peri-articular Fibrositis

Fibrositic changes may be found in the palmar fascia or in its prolongations to the fingers, and the resulting contractions gives rise to an affection very similar to that described by Dupuytren.

Similar changes are to be discovered in the capsule and in the ligaments surrounding the finger-joints, without any implication of the articular surfaces. This condition is frequently met with in gardeners and elderly labourers and generally results in gross distortion of the joints. They appear to be swollen but a closer examination will reveal that the synovial capsule is not distended in any way and that the enlargement is really due to capsular thickening and the displacement of bone-ends.

Section of Tropical Diseases and Parasitology

President—H. S. STANNUS, M.D.

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Recent Laboratory Contributions to the Control of Yellow Fever

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ABSTRACT.—The most important recent laboratory contributions to the control of yellow fever will be briefly summarized under three headings: (1) Methods of diagnosis, (2) Transmission, and (3) Protection.

(1) *Methods of diagnosis.*—The development of improved methods of identification, in particular by immunity tests, has made it possible to diagnose yellow fever with much greater certainty. Moreover, since the immunity following an attack of the disease is usually of life-long duration, it is possible to determine what proportion of any particular population has been infected and also how long any district has been free from infection. The application of immunity tests to the delimitation of endemic zones, especially in West Africa, has led to a great increase in our knowledge, and yellow fever has been found to have a much wider distribution than was previously suspected. Among other methods of recognizing the disease may be mentioned complement-fixation tests and also in post-mortem material the histopathology of the liver.

(2) *Methods of transmission. Indirect.*—The main factors in the transmision of the disease by mosquitoes have been elucidated, and the relations between the course of the infection in monkeys (and also presumably in man) and the infectivity of these animals to mosquitoes. It is found that the blood becomes infective at a very early stage, before febrile symptoms develop, and that infectivity usually disappears three to four days after the onset of fever, owing to the presence of immune bodies in the blood. It is evident that any yellow fever patient must be considered to have been capable of infecting mosquitoes before showing any signs of the disease. Many other species of mosquitoes in addition to the *Aëdes ægypti* have now been shown capable of transmitting yellow fever.

Direct.—It is now known that it is possible to acquire yellow fever in the absence of mosquitoes, through handling infected material. Many cases of laboratory infection have now been recorded in which other sources of infection can be definitely excluded.

(3) *Protection.*—The most important advance in this direction has been the development of practicable methods of vaccination. The use of attenuated virus was followed by the use of virus and immune serum. The development of the latter has depended mainly on the discovery that when yellow fever virus is inoculated intracerebrally into mice, after a few passages it acquires neurotropic affinities and loses to a great extent its capacity for producing a general infection. The use of such virus, combined with human or animal immune serum, has been found to result in the development of a high degree of immunity comparable in intensity with that following an attack of the disease.

RÉSUMÉ.—Les travaux de laboratoire les plus importants sur la fièvre jaune seront résumés sous trois rubriques: (1) méthodes de diagnostic, (2) transmission, (3) protection.

(1) *Méthodes de diagnostic.*—Le développement de meilleures méthodes d'identification, surtout par les réactions d'immunité, a rendu possible le diagnostic beaucoup plus précis de la fièvre jaune. De plus, comme l'immunité qui suit la maladie dure généralement toute la vie, il est possible de découvrir quelle proportion des habitants a été infectée, et depuis quand une région est restée sans infection. L'application des réactions d'immunité à la délimitation de zones endémiques, surtout en Afrique occidentale, a beaucoup augmenté nos connaissances, et on a trouvé une distribution beaucoup plus étendue qu'on ne l'avait pensé auparavant. Entre autres méthodes de diagnostic il faut signaler la fixation du complément, et, dans les cas d'autopsie, l'histopathologie du foie.

Transmission : Transmission indirecte. —Les principaux facteurs dans la transmission de la maladie par les moustiques ont été étudiés ainsi que les rapports entre le cours de la maladie chez les singes (et probablement chez l'homme) et la contagiosité de ces animaux pour les moustiques. On a observé que le sang devient infectieux à un stade très précoce, avant l'apparition de la fièvre, et que la contagiosité disparait généralement deux ou trois jours après le début de la fièvre, à cause de la présence de corps immuns dans le sang. Il est évident que le malade doit être considéré comme ayant été capable d'infecter des moustiques avant de montrer aucun signe de maladie. Beaucoup d'espèces de moustiques en plus de *l'Aëdes ægypti* se sont montrés capables de transmettre la fièvre jaune.

Transmission directe.—On sait maintenant que l'infection par la fièvre jaune est possible sans l'intervention de moustiques, par le maniement de matières infectées. Plusieurs cas d'infection de laboratoire ont été publiés dans lesquels d'autres sources d'infection peuvent être exclues.

(3) *Protection.*—L'avancement le plus important de ce côté est le developpement de méthodes pratiques de vaccination. Le virus atténué a été suivi du virus et du sérum immun. L'évolution de cette dernière méthode dépend surtout de la découverte que quand le virus de la fièvre jaune est administré dans le cerveau de la souris il acquiert, après quelques passages, des qualitiés neurotropiques, et perd en grande partie son pouvoir de produire une infection générale. L'emploi d'un tel virus, avec du sérum immun humain ou animal, produit un degré d'immunité comparable à celui qui suit la maladie.

ZUSAMMENFASSUNG.—Die wesentlichsten Beiträge zur Gelbfieberbekämpfung werden kurz unter 3 Köpfen zusammengefasst: (1) Diagnose, (2) Übertragung, (3) Schutzmassnahmen.

(1) *Diagnose.*—Die Entwicklung besserer Identifikations-methoden, hauptsächlich durch Immunitätsproben, ermöglicht die viel sicherer Diagnose des Gelbfiebers. Ferner ist es möglich, da die Immunität die der Gelbfieber Erkrankung folgt gewöhnlich das ganze Leben dauert, in irgendeiner Bevölkerung das Verhältnis von Individuen die die Krankheit durchgemacht haben zu bestimmen, und auch wie lange ein Bezirk frei von Infektion geblieben ist. Die Anwendung Immunitätsproben für die Begrenzung endemischer Zonen, hauptsächlich in West-Afrika hat unsere Kenntnisse viel vermehrt, und hat gezeigt dass das Gelbfieber viel mehr verbreitet ist als man früher annahm. Unter anderen Methoden zur Erkennung dieser Krankheit muss man Komplementfixierungs-Reaktionen und, bei Sektion, die Histopathologie der Leber nennen.

(2) *Übertragung : Indirekte Übertragung.* — Die hauptsächliche Faktoren in der Uberträgung durch Schnaken, und die Verhältnisse zwischen dem Krankheitsverlauf in Affen (und wahrscheinlich auch beim Mensch) und der Infektivität dieser Tier für Schnaken sind aufgeklärt geworden. Das Blut wird sehr frühzeitig infektiös, schon vor dem Auftreten febriler Erscheinungen, und die Infektivität schwindet 3-4 Tage nach dem Auftreten des Fiebers, wegen dem Vorhandensein von Immunkörper im Blut. Offenbar müssen Gelbfieber Kranke als vor dem Auftreten der Krankheitserscheinungen infektiv für Schnaken angesehen sein. Viele andere Arten von Schnaken neben *Aëdes aegypti* haben sich als Uberträger von Gelbfieber erwiesen.

Direkte Übertragung.—Wir wissen jetzt dass Gelbfieber infektion auch ohne Schnaken möglich ist, durch Berührung infizierter Stoffe. Viele Fälle von Laboratoriumsinfektionen sind berichtet worden, wo andere Infektionsquellen absolut ausgeschlossen sind.

(3) *Schutzmassnahmen.*—Der wichtigste Fortschritt auf diesem Gebiet ist die Entwicklung praktischer Impfmethoden. Der Gebrauch von abgeschwächtem Virus wurde von dem von Virus und Immunserum gefolgt. Die Entwicklung des letzteren hängt hauptsächlich von der Entdeckung ab, dass Gelbfiebervirus, intrazerebral in Mäuse eingespritzt, nach einigen Passagen neurotropische Eigenschaften bekommt, und seine Kapazität Allgemeininfektionen zu erzeugen in grossem Masse verliert. Die Anwendung eines solchen Virus mit menschlichem oder tierischem Immunserum ergibt eine hochgradige Immunität, vergleichbar mit der die die Erkrankung erzeugt.

I PROPOSE in this paper to refer briefly to some of the more important laboratory contributions that have been made recently on the control of yellow fever. These will be discussed under three headings, (1) methods of diagnosis, (2) methods of transmission and (3) protection.

(1) METHODS OF DIAGNOSIS.

Unfortunately, there is still no certain method of making a clinical diagnosis of mild cases, in which the characteristic symptoms may be lacking. It is now possible, however, to be wise after the event and decide whether any patient has suffered from the disease, for an attack of yellow fever, no matter how slight, seems to leave behind it a high degree of immunity which generally persists for life. The presence of immune bodies in the blood can be detected in a variety of ways.

The method which has given the most satisfactory results is the application of protection tests in animals. This usually consists of inoculating a susceptible animal with a dose of the serum to be tested, followed by an injection of yellow fever virus. If the serum contains immune bodies against yellow fever, the experimental animal does not become infected but further becomes immune against the disease. Originally, *rhesus* monkeys were used for these tests, but their cost prevented any very extensive investigations. The most important tests of this nature are those of Beeuwkes, Bauer and Mahaffy in West Africa, which have demonstrated the existence of a high degree of infection with yellow fever in certain parts of Nigeria. The use of monkeys has now been almost entirely superseded since Theiler's discovery that mice can be infected with yellow fever. This discovery has had such important developments that I shall refer to it in greater detail.

A normal adult mouse inoculated, either intraperitoneally or subcutaneously, with ordinary yellow fever virus shows no signs of generalized infection and the virus soon disappears from its body. If, however, the virus is inoculated intracerebrally, the mouse develops signs of encephalitis and generally dies of the disease after six to ten days. The virus can now be recovered from the nervous system of such an animal and also from the suprarenal glands, but is absent from all other tissues, including the blood. A suspension of the brain of such a mouse can be used for the intracerebral infection of successive mice, and after a few passages through the brains of mice, the yellow fever virus changes its character, acquiring neurotropic properties, and loses to a great extent its power of producing a general infection in man or in monkeys. If such neurotropic mouse virus is inoculated intraperitoneally or subcutaneously into a monkey susceptible to yellow fever, it generally produces nothing more than a slight febrile reaction, with none of the ordinary signs of the disease, but the animal develops an active immunity against yellow fever. I should like to emphasize the great biological interest of this modification in the properties of yellow fever virus after cerebral *passages* in mice. Commencing with the ordinary viscerotropic virus occurring in large quantities in the blood and affecting mainly the hepatic cells, a few *passages* in the brains of mice are sufficient to entirely change the properties of the virus as far as its pathogenic action is concerned, for it becomes a neurotropic virus producing encephalitis in animals such as mice and certain other rodents which are normally resistant to the original virus. Moreover, the process seems to be irreversible, for up to the present no method has been discovered of recovering the ordinary viscerotropic virus from the fixed neurotropic one. The immunity conferred by the two kinds of virus is indistinguishable except by precipitation tests; moreover immune serum from yellow fever patients protects mice against infection with neurotropic virus. Consequently it is now possible to make immunity tests on a very much larger scale by using this mouse protection test. It is unnecessary to go into technical details except to mention that Sawyer and his colleagues prefer to inoculate the virus and immune serum intraperitoneally into

mice that have received a slight brain injury by the intracerebral inoculation of a small quantity of starch, whilst Theiler recommends the intracerebral inoculation of a mixture of the serum to be tested with the neurotropic virus. In either case presence of immune bodies against yellow fever protects the mice against infection.

This method is now being applied on a large scale for the delimitation of endemic zones of yellow fever. Blood is being collected in various districts and the sera forwarded to central laboratories in New York, London and Paris, where they are tested for the presence of yellow fever immune bodies. The results are of considerable interest for they have revealed the existence of yellow fever in regions where its presence had never even been suspected. Consequently, we are now obtaining a much clearer idea of the range of this disease; once the endemic areas have been delimited it will be easier to devise effective methods of control.

Other methods of diagnosis are subordinate to protection tests; complement-fixation has given good results in the hands of certain investigators, and has the advantage of not requiring animal experiments and the consequent delay. However, this method is not wholly reliable as an indication of the degree of endemicity, for certain cases of the disease seem to show no significant alterations in the complement. Recently, Hughes has described a *precipitation* reaction, but this is not likely to have any practical value in epidemiological studies.

In post-mortem material the characteristic acidophile necrosis in the liver has been supplemented by the discovery that the nuclei of hepatic cells may show specific changes resulting in the appearance of acidophilic material in the nucleoplasm. Although constantly found in monkeys dying of yellow fever, their presence is much less constant in human cases, and the older methods of pathological diagnosis would seem to be more reliable when dealing with human material.

(2) Methods of Transmission.

(*a*) *Indirect transmission.*—An important advance in our knowledge of the insect transmission of the disease has been the discovery that many other species of mosquitoes, in addition to *Aëdes ægypti*, are capable of transmitting yellow fever—at least under experimental conditions. The accompanying table contains a summary of the results of transmission experiments with various species of insects from which it will be seen that at least twelve species of mosquitoes are capable of transmitting the infection by their bite. Some of these species transmit the disease from infected to normal monkeys with such certainty that there can be little doubt that they are potential carriers of yellow fever. Unquestionably *Aëdes ægypti* is the true yellow fever mosquito and in anti-mosquito campaigns its destruction is by far the most important consideration, but should any of these other species be present in considerable numbers, the possibility of the infection being maintained by them cannot be entirely ignored.[1]

With reference to the exact manner of transmission, it would seem that the virus does not multiply in the body of the mosquito, but after being taken into the stomach it passes through the walls of the alimentary tract and enters the cœlomic fluid. The virus in this fluid is thus brought in contact with the various internal organs, but for some unknown reason an interval of days or weeks elapses before the virus enters the salivary glands in sufficient quantity to produce infection when the insect bites a susceptible animal. The length of this so-called extrinsic incubation period depends mainly on the temperature, being extremely prolonged at 18° to 20° C., but becoming shorter as the temperature rises, so that at 37° C. it may be as short as four days (eighteen days at 21° C.; and eight days at 25° C.). Below 18° C. the

[1] Recently a mild epidemic of yellow fever, in the absence of *Aëdes Egypti*, has been recorded in the Chanaan Valley, State of Espirito Santo, Brazil. (Rockefeller Foundation, Annual Report, 1932, pp. 51-53.

TABLE SUMMARIZING THE RESULTS OF YELLOW FEVER TRANSMISSION EXPERIMENTS WITH VARIOUS SPECIES OF INSECTS OTHER THAN *Aëdes ægypti*.

Species of insect	Locality	Number of days since meal of infectious blood	Biting or injection	Results	Authority
Aëdes luteocephalus ...	W. Africa	15-53	Biting	Efficient carrier	Bauer, 1928
*A. stokesi**	,,	18-33	,,	,,	,, ,,
A. apico-argenteus ...	,,	17-30	Both	Negative	,, ,,
A. vittatus	,,	11-39	,,	Positive	Philip, 1929
A. africanus	,,	12-21	,,	,,	,, ,,
A. simpsoni	,,	19-43	,,	,,	,, ,,
A. irritans	,,	"Adequate incubation period"	Injection	,,	,, 1930b
A. nigricephalus ...	,,	,,	,,	,,	,, ,,
A. punctocostalis ...	,,	,,	,,	,,	,, ,,
A. scapularis† ...	Brazil	13-30	Both	,,	Davis and Shannon, 1929
A. serratus	,,	17-31	Injection	,,	,, ,,
A. tæniorhynchus ...	,,	16-23	Both	,,	,, 1929 and 1931a
A. fluviatilis	,,	15-19	,,	Efficient carrier	,, 1931a
A. terrens	,,	11-17	Injection	Positive	,, 1931b
A. fulvithorax ...	,,	12-20	,,	Negative	,, ,,
A. albopictus	Java	Various	Both	Positive but inefficient carrier	Dinger and Colleagues, 1929
Psorophora cingulata ...	Brazil	13-15	Injection	Positive	Davis and Shannon, 1931b
P. ferox	,,	20	,,	,,	,, ,,
Eretmopodites chrysogaster	W. Africa	16-24	Both	,,	Bauer, 1928
Trichoprosopon (Joblotia) digitata	Brazil	Various	Injection	Negative	Davis and Shannon, 1931b Kumm and Frobisher, 1932
Culex sp.?	Brazil	15-27	Biting	,,	Marchoux and Simond, 1906
C. fatigans ? quinquefasciatus	,,	20	,,	,,	,, ,,
C. quinquefasciatus ...	,,	Various	Both	Doubtful	Davis and Shannon, 1929 and 1931b
C. thalassius	W. Africa	27-49	,,	Positive	Kerr, 1932; Philip, 1930b
Wyeomyia bromeliarum	Brazil	16-32	Injection	Negative	Davis and Shannon, 1931a
W. oblita	,,	14-18	,,	,,	,,
Limatus durhami ...	,,	15	,,	,,	,,
Mansonia fasciolata ...	,,	14-21	,,	Positive	,, 1931b
M. chrysonotum ...	,,	14-15	,,	,,	,,
M. albicosta	,,	15	,,	,,	,,
M. titillans	,,	14-30	,,	,,	Kumm and Frobisher, 1932
M. uniformis	W. Africa	15-24	Injection	,,	Kerr, 1932
M. (Tæniorhynchus) africanus	,,	16 or more (in biting experiments)	Both	,,	Philip, 1930a
Anopheles albitarsis ...	Brazil	12	,,	Negative	Davis and Shannon, 1931b
A. tarsimaculatus ...	,,	12-18	,,	,,	,, ,,
A. gambiæ	W. Africa	1-4	Injection	Positive	Philip, 1930a ,,
Cimex lectularius ...	Brazil	2-12	,,	Fæces infective	Monteiro, 1929
C. hemipterus	,,	2	,,	Positive, but negative after second day	Kumm and Frobisher, 1932
Triatoma megista ...	,,	7	,,	Doubtful	Davis and Shannon, 1931a

* Referred to as *Aëdes apicoannulatus* in the original paper.

† Marchoux and Simond (1906) record negative feeding experiments with *C. confirmatus*, a synonym of this species.

mosquitoes do not become infective, but there is no attenuation of the virus, and if at any subsequent time the insect is heated it may become infective. If after an infected meal a mosquito is cooled before the expiration of the extrinsic incubation period, it may become infective at any subsequent time, if exposed to a sufficiently high degree of temperature to reactivate the virus. The virus is not destroyed when mosquitoes are cooled, consequently the infection may persist in these insects under seasonal conditions which prevent the development of the disease itself.

Can the virus persist in a mosquito population in the absence of a vertebrate host?—The answer to this important epidemiological question seems to be an unqualified negative, for there is no evidence to support the view that a mosquito population continues to remain infective in the absence of the vertebrate host. Much attention has been devoted to the question of hereditary transmission of the virus in the mosquito, since many years previously Marchoux recorded an experiment suggesting that the offspring of infected parents were also infective. In view of the fact that the yellow fever virus invades the cœlomic fluid which bathes the ovaries of the mosquito, there seems to be no reason why it should not enter the ova, as *e.g.*, in the case of the fowl spirochætes in *Argas persicus*, but hitherto every attempt to find virus in the eggs laid by infected mosquitoes, or in the mosquitoes developing from these eggs, has given uniformly negative results.

It has also been suggested that the infection might be maintained in an insect colony by means of coitus, since there was evidence that when normal mosquitoes of one sex were placed in contact with infected ones of the opposite sex and subsequently ground up and inoculated into normal animals, these became infected with yellow fever. This observation can be explained on the supposition that the bodies of the normal mosquitoes were contaminated by the fæces of the infected ones. It is known that the fæces may contain virus and when male and female mosquitoes are confined together, it is possible for their bodies to be contaminated by infective material. Such surface contamination, however, has no epidemiological significance and, when colonies of infected mosquitoes have been kept under conditions permitting the development of their offspring and the consequent influx of new mosquitoes, the infection dies out within about sixteen weeks, the length of time a mosquito might be expected to survive. (In a moist chamber, 116 to 169 days.)

Period of infectivity of the blood.—In connexion with the transmission of yellow fever the period of infectivity of the blood is of considerable importance. It is commonly stated that the incubation period does not exceed six days and that the blood is infective only during the first three days of the attack. However, in the two cases recorded by Low and Fairley, both had incubation periods of ten days and it is known from observations on monkeys that the blood is infective during part of the incubation period. In monkeys the virus appears in the blood within a few hours after the inoculation, although symptoms of the disease may not appear until some days later. The presence of virus in the blood is followed by the development of antibodies which render the blood non-infective to mosquitoes before the virus has disappeared, for a mixture of virus with a sufficient quantity of immune serum fails to infect mosquitoes, although a similar mixture inoculated into monkeys may produce infection. The period during which the blood is infective probably varies considerably, for virus has been recovered on the fourth day after the beginning of fever. How soon the blood becomes infective probably varies according to the dose and other conditions, but I think it would be wise to consider the blood of a patient infective at least three days before the appearance of fever.

(*b*) *Direct transmission.*—It has now been shown beyond any question that it is possible to acquire yellow fever by handling infective material. Two hospital infections have occurred, in which patients acquired the disease whilst performing the ordinary routine examinations of cases of yellow fever, and in which the presence of mosquitoes could be excluded. From an epidemiological point of view, however,

this method of transmission is probably of little importance, but as pointed out by Low and Fairley, in all cases in which yellow fever may be present attention should be paid to this method of infection when making blood-counts or any similar examinations.

(3) Methods of Protection.

The most important advance in this direction has been the development of practicable methods of vaccination. Five years ago I showed that when yellow fever virus is exposed to the action of various agents, such as phenol and glycerine, formaldehyde, or even kept exposed to air, it gradually loses its virulence and then passes through a stage when it can act as a vaccine, producing immunity without any obvious signs of disease. After further exposure this vaccine stage is followed by a gradual loss of all antigenic properties. Vaccines of this character, although used with success in the last epidemic of Rio de Janeiro, were found to present considerable practical difficulties in their preparation, since the amount of exposure necessary to convert the virus into a vaccine differed in individual preparations, and it was difficult to estimate the exact time required to destroy virulence without affecting the antigenic properties. As I showed subsequently, if such vaccines were dried or preserved in a refrigerator, they maintain their properties for long periods, and this method has recently been applied to the preparation of vaccines from mouse-brain virus. Laigret recommends the use of three injections of such virus, the first injection of completely non-virulent material, the second injection of virus lethal to mice in doses of $\frac{1}{10}$ to $\frac{1}{100}$ c.c., but not in smaller quantities, and a third injection of material lethal to mice in doses of $\frac{1}{100}$ to $\frac{1}{1000}$ c.c., but not beyond these dilutions. The infected mouse brains are attenuated by keeping in glycerin at room temperature for one to four days and then either dried or kept in the refrigerator at approximately $-15°$ C., when the virus retains its properties for long periods. This method has the advantage of not requiring immune serum, but the disadvantage of requiring three separate injections at intervals of twenty days, and of course, the possibility of the blood being infective.

The method of protection which has given the most satisfactory results up to the present is the use of combined living virus and immune serum. The ordinary yellow fever virus is too dangerous to employ for this method, but the neurotropic mouse virus referred to previously gives equally good results and its use does not involve such technical difficulties.

The method of vaccination elaborated by Sawyer and his colleagues consists of the injection of a mixture of mouse virus and human immune serum, followed after a short interval by separate injections of human immune serum sufficient to prevent the appearance of virus in the blood. The quantity of human immune serum required is about 30 to 45 c.c. for each patient. The degree of immunity which develops after this method of vaccination is similar in intensity to that following an attack of the disease, and the presumption is that it will be of long duration. This method has been used for the protection of a considerable number of subjects by Sawyer and his colleagues at the Rockefeller Institute, New York, by Findlay at the Wellcome Research Institution, London, and by Aragão in Brazil.

Some modifications of this method have been devised in order to overcome the practical difficulties entailed by the use of large quantities of human immune serum. Pettit and Stefanopoulo find that animal anti-yellow fever serum, prepared in horses or baboons, gives equally good results, and also it is unnecessary to use such large quantities of serum. Findlay has also applied a method of intradermal vaccination which may obviate the necessity of using more than 1 or 2 c.c. of serum for each patient.

Conclusion.—It will be seen that recent laboratory investigations, whilst in the main confirming the results of earlier work in which human volunteers were used, have modified our information in various details, notably in the case of methods of

transmission and also in the methods of diagnosing the disease. Some of the older sanitarians who have had practical experience of yellow fever epidemics, and their rapid suppression by the application of the principles laid down by the earlier investigators, seem to view the results of laboratory studies with a certain amount of suspicion, and tend to ignore the wider risks of infection indicated by some of their results.

It is well to remember the comparative ease with which yellow fever epidemics can be suppressed in appraising the value of these statements. But to suggest, as seems to have been the case, that the measures for prevention and control drawn up by the Yellow Fever Commission for the International Sanitary Convention for Aerial Navigation, exceed the needs of the case, and are a concession to the alarmist point of view, seems to me most unfortunate. If such is the case, then from the point of view of the permanent control of yellow fever I frankly admit that I belong to the so-called alarmists. The successful control of epidemics is not quite the same problem as the permanent suppression of yellow fever, and unless care is taken to guard against even the exceptional methods of transmission indicated by laboratory experiments, there is always the remote possibility of yellow fever being carried to regions where favourable climatic conditions, combined with the presence of *Aëdes ægypti*, might lead to fresh outbreaks.

The present distribution of the disease suggests that in West Africa, its original home, the disease has widely extended its range during recent years, in spite of the successful control of isolated epidemics. In 1931 there were no less than 40 cases of actual yellow fever in Europeans in French West Africa, and the localities ranged from Senegal to Garkidda in Nigeria; and in Brazil there were 34 cases in 13 different and widely scattered localities ranging from Rio to Ceara, and isolated cases in Bolivia and Colombia. Yet I remember a few years ago listening to an interesting account of how yellow fever had been completely eradicated from South America!

As the result of recent laboratory investigations we have now precise methods of diagnosis applicable to the delimitation of endemic zones of the disease, a more exact knowledge of its transmission, and finally methods of protection. With international co-operation in the use of these weapons, I think there is little doubt of the effective control and final eradication of yellow fever.

Full references to the literature of this subject will be found in the Yellow Fever Section of the *Tropical Diseases Bulletin*.

Colonel S. P. JAMES agreed that the articles relating to yellow fever in the International Sanitary Convention of 1926, and the International Sanitary Convention for Aerial Navigation of 1933, did not cover all the possible risks indicated by the results of recent laboratory research. Any of those happenings in laboratory experiments might also happen, exceptionally, under natural conditions, just as it had been found, very rarely, that the incubation period of cholera might be as long as sixteen or eighteen days instead of being limited to the five days mentioned at the International Sanitary Convention of 1926. But it was the practice to base international regulations on what occurred in the immense majority of cases rather than on what might occur quite exceptionally, and it had been found by experience that this practice provided adequate safeguards against spread. This was one of the reasons why the new Sanitary Convention for Aerial Navigation made provision for some, but not all, of the possible risks indicated by the results of recent laboratory experiments. Another point in Dr. Hindle's paper to which he would like to refer briefly was the fact that, by the application of the "mouse-protection test," yellow fever had been found to have a much wider distribution than had been previously suspected. This was an important finding, but in the future a distinction might have to be made between the geographical distribution of the virus of yellow fever and that of the clinical disease itself. The geographical distribution of the virus (as indicated by results of the protection test) might be found to be much more extensive than the geographical distribution of recognizable clinical cases and it might have to be assumed that in certain regions infection with the virus brought about in the majority of individuals, immunization without clinical disease.